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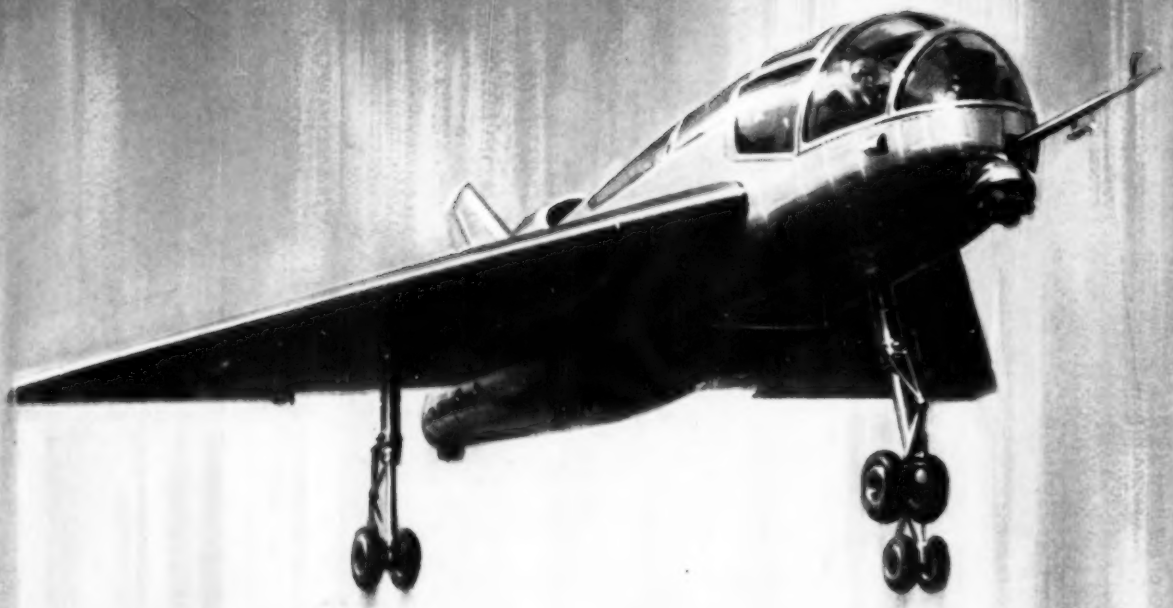

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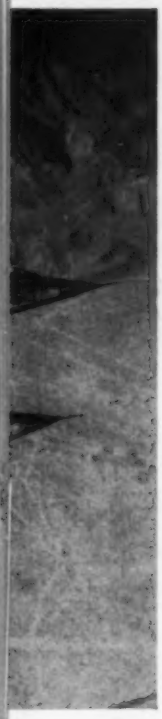

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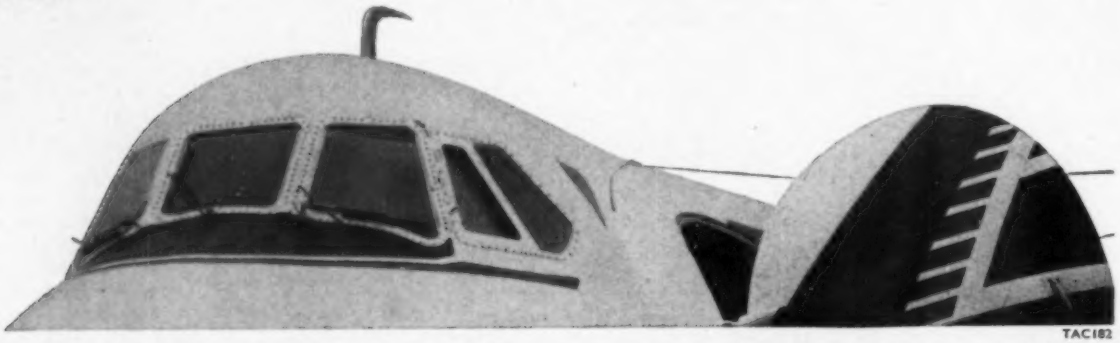

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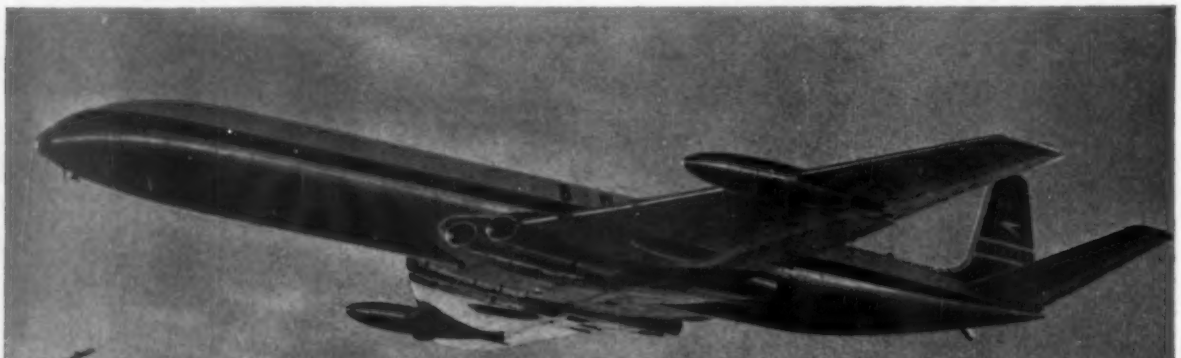

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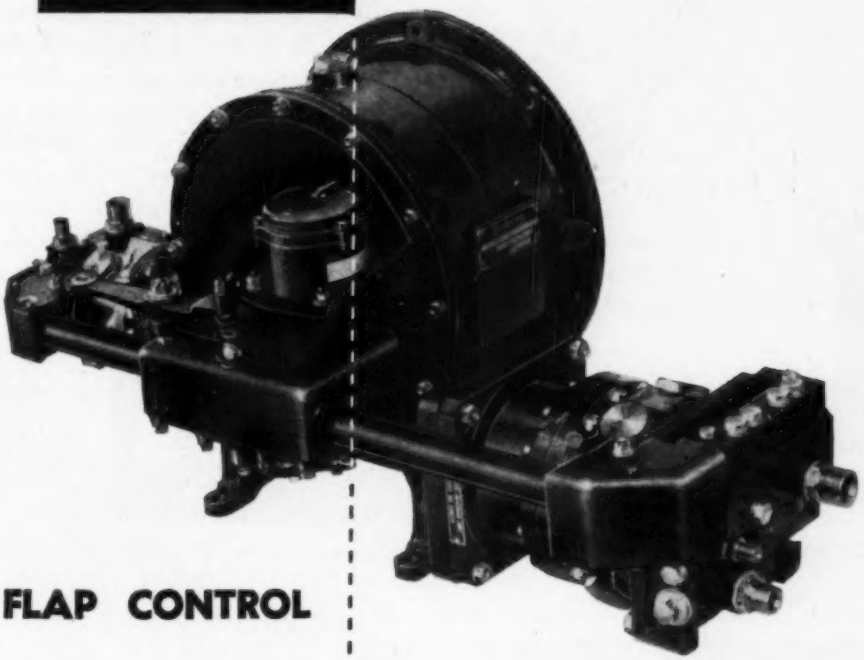

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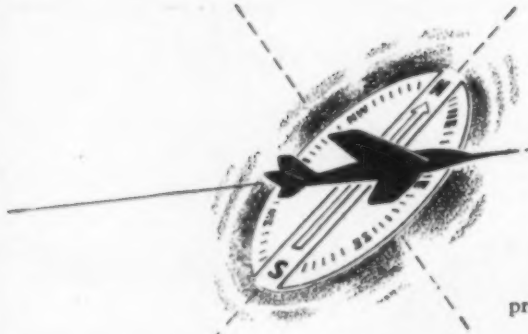

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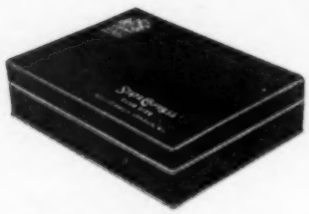

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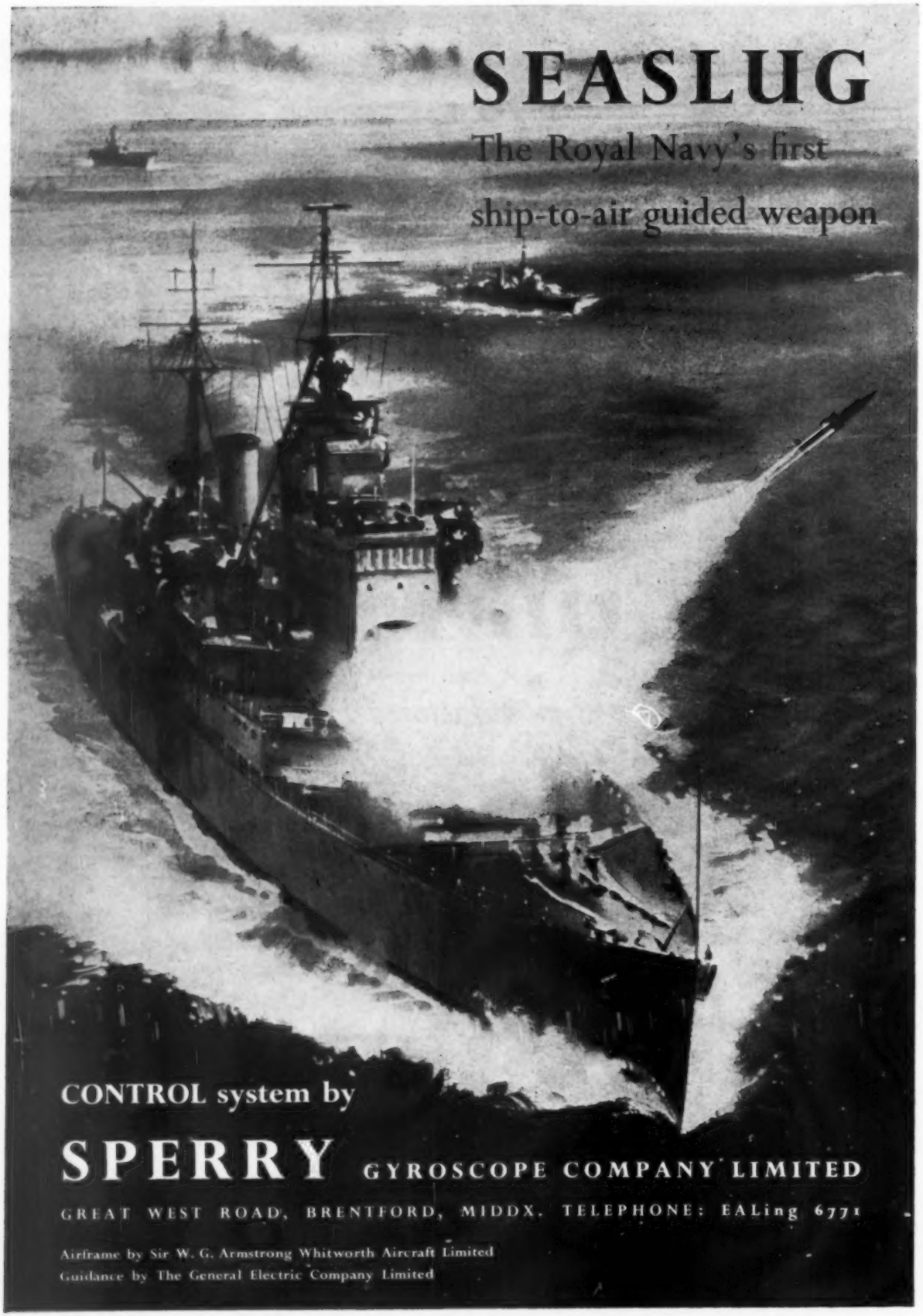
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No 2600 Vol 74 FRIDAY 21 NOVEMBER 1958

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Striking Off-shore

IN the discussion that followed the Fifth Sir George Cayley Memorial Lecture (Mr. G. E. Petty on the history of the Blackburn company: *Flight* last week), a youthful member of the audience rose to enquire if America was going to buy the NA.39 naval strike aircraft and what was going to happen to Blackburn in the space age.

Now to prefer Snarks to Sharks is no unhealthy sign; and while we must not usurp the prerogative of Blackburn's own youthful and farsighted chairman to tackle the second stage of this cosmic probe, we may permit ourselves some comment on the first. As a preliminary—the NA.39 being, in its present form, a naval aeroplane—we shall get America's Assistant Secretary of the Navy (Air) to speak for himself.

Writing in *American Aviation* he has said: "Among the principal elements of Navy striking power are the attack carrier forces and the amphibious groups, tailored for action in limited war. The manned aeroplane will continue to be essential to these forces. There is no weapon development in sight which will replace the piloted attack aeroplane for precise discriminating delivery of the needed firepower under changing tactical situations and in the support of troops. In nearly every facet of naval operations we see now and foresee in the future the manned aeroplane as an ever-important link in the chain of naval strength . . ."

So there is no doubt that an aeroplane of NA.39 type—a transonic low-level carrier-based bomber—is an American requirement; and, this being so, it is likely to be sought after by other powers possessing carriers. Following completion of some twenty development prototypes a production order for our own Fleet Air Arm has lately been confirmed. The question now is whether the American naval requirement can be met by Grumman's forthcoming A2F.

To remark that the A2F is a later aircraft than the NA.39 is certainly not to imply that it is more advanced. Indeed, it is thought to be an aeroplane of essentially similar layout, powered with Pratt and Whitney J52 turbojets which are comparable in output to the NA.39's de Havilland Gyron Juniors. Should its structural strength even approach that of the NA.39 (robustness of an exceptional order is imperative for sustained low-level operation and near-sonic strikes in dense, turbulent air) it will be immensely strong; and if its high-lift devices are any match for the Blackburn's in effectiveness, its speed range will be of a quite uncommon order.

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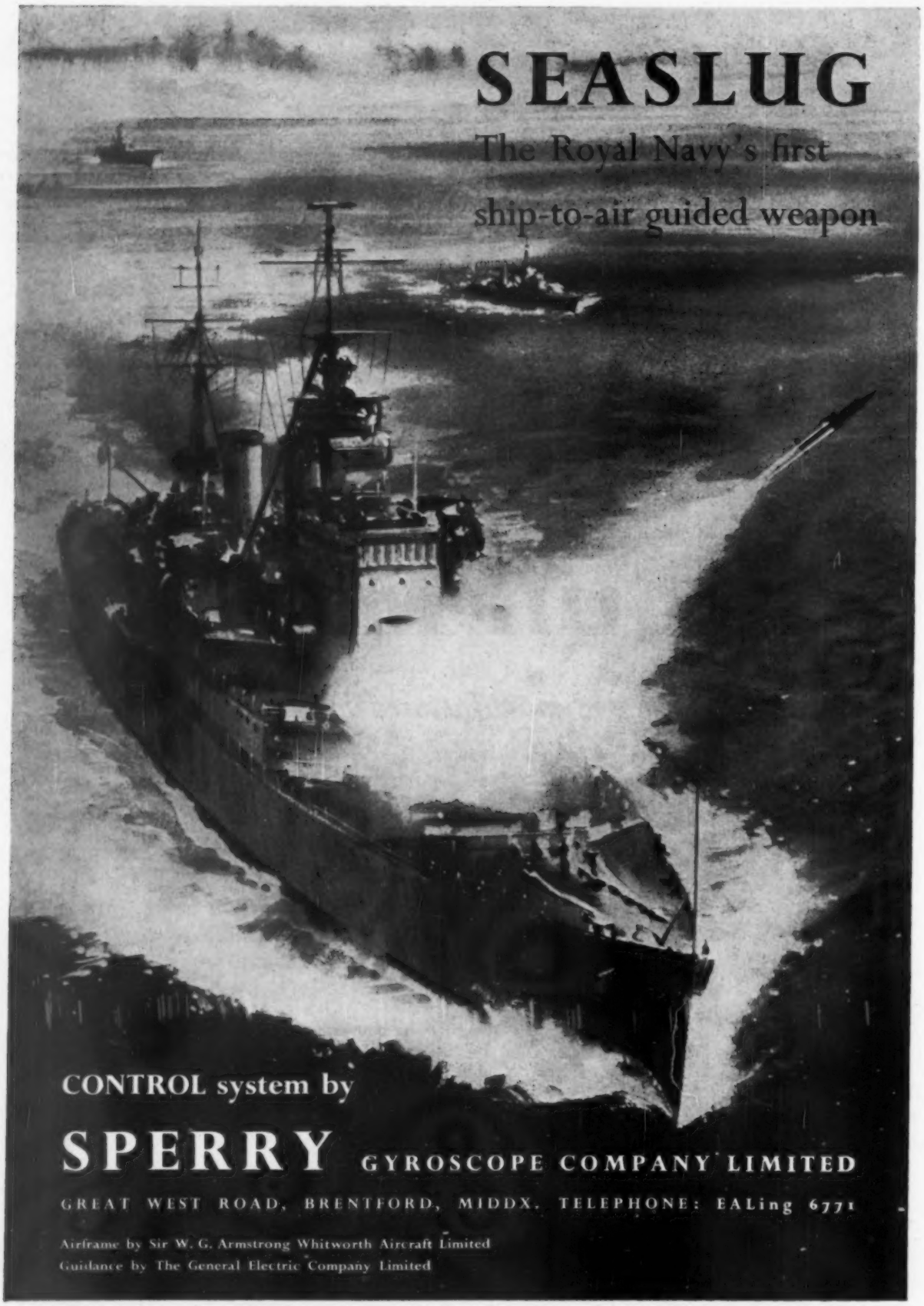
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FROM ALL QUARTERS

Rotorcycles by Saro

SAUNDERS-ROE, Ltd., have entered into an agreement with Helicop-Air, Paris (European agents for the Hiller Aircraft Corporation), to build a number of Hiller XROE-1 Rotorcycles. When some of these one-man helicopters have been completed they will be sent to America for evaluation by the U.S. Services.

Powered by a 43 h.p. Nelson engine, the Hiller Rotorcycle weighs under 250 lb and can be packaged into easily transportable form in a matter of minutes.

D.H. Appointments

A NUMBER of Board and senior executive appointments have been announced by the de Havilland aircraft and engine companies; they include directorships for Mr. C. T. Wilkins and Mr. John Cunningham. The retirement of Mr. Harry Povey is also announced. Full details appear on page 814 of this issue.

Oriental Debut

TWO Vulcans of No. 83 Sqn. are due to arrive at Butterworth, Malaya, next Monday (November 24), having flown out from R.A.F. Waddington. They will make a 3,040 st. mile non-stop flight from Karachi, their visit to the Pakistan capital (where they are scheduled to arrive today, Friday) being a first appearance there for this type of aircraft.

One of the Vulcans, captained by W/C. L. F. Banks, who commands No. 83 Sqn., and with A.V-M. G. A. Walker, A.O.C. No. 1 Group (and Force Commander) as co-pilot, was also due to make another "first appearance" en route—at Ankara, where it was scheduled to arrive last Tuesday after a 2,720 st. mile trip from Waddington. The Vulcans are being supported by a Comet of No. 216 Sqn. and a Hastings of No. 99 Sqn.

No Reprieve for Croydon

CONFIRMATION that all club flying at Croydon Airport must end on December 31 was given during a 90-minute adjournment debate in the House of Commons on November 14 by Mr. Airey Neave, Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation. For "charter and executive fliers and other business firms," Mr. Neave said, the airport would remain open for "a very limited period" after this date, provided these tenants "make genuine efforts to avail themselves of one or other of the alternative offers which have been put to them."

The subject of Croydon had been raised by Mr. Frank Beswick, who reviewed the reasons for retaining the airport as a base for light aircraft. Other speakers who supported the case for Croydon were Col. C. F. H. Gough, G/C. C. A. B. Wilcock and Mr. J. A. Leavey, while agreement with the Government's policy of closure was voiced by Vice-Admiral J. Hughes-Hallett.

Mr. Neave said in his reply that the Government was considering the problem of providing a centre for private aviation in the south-east of England. He made the following observation: "Looking at the map, it is difficult to find a suitable place that meets all these difficulties if one accepts that Croydon must be closed." (R.Ae.C. statement on Croydon: page 804.)

BACK TO BRISTOL, after 46 years, goes Major Bernard Fowler, seen here in a Britannia. His original visit was to buy a Boxkite for £275 (a single Britannia propeller costs about 25 times as much). The major took tea with assistant chief test pilot Godfrey Auty. The Boxkite was a pusher biplane with 50 h.p. Gnome engine

Variable-geometry Talks

DISCUSSIONS have been going on in the United States as to the possibility of joint Anglo-American research on variable-geometry aircraft in general and the Swallow project in particular. With a possible future NATO requirement as basis, the talks have been held between representatives of the National Aeronautics and Space Administration and a joint Vickers-M.o.S. team. Dr. Barnes Wallis led the company representation and Mr. P. A. Hufton (Chief Superintendent, R.A.E. Bedford) and Mr. John Christie (Assistant Secretary, Air B2) participated for the Ministry.

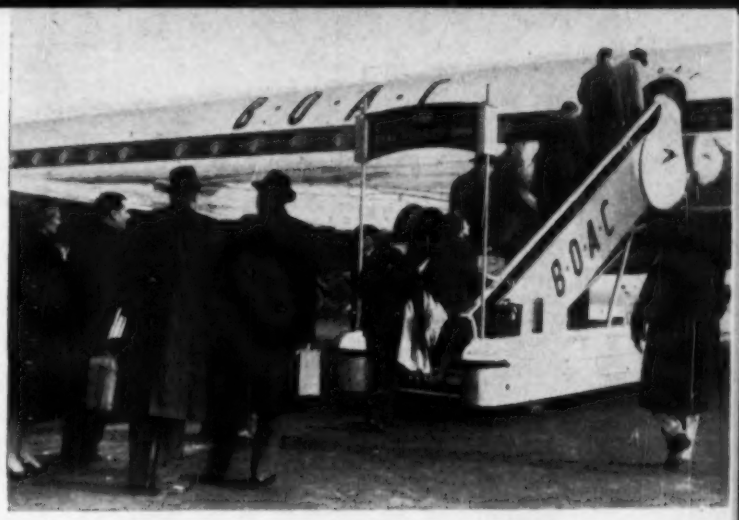
A motion which has a bearing on the Swallow project was tabled last week by three Conservative back-benchers. It urges the Government to make capital available to the aircraft industry to prevent the sale to foreign Powers of outstanding new aeronautical inventions. Its sponsors were Mr. F. W. Farey-Jones (Watford), Mr. G. B. H. Currie (County Down, North) and Mr. A. J. McKibbin (Belfast, East).

Improved Precision Approach

FULL development of the SLA.3 precision approach radar has now been completed by Standard Telephones and Cables, Ltd., and production is under way. A number of SLA.3s have been ordered for the R.A.F. and will include displays for mounting in control towers, with electronics and aerial system mounted in a specially designed light alloy caravan made by Blackburn and General Aircraft.

The SLA.3 is the result of a detailed and lengthy assessment of P.A.R. requirements in performance, accuracy and maintenance. The transmitter/receiver, video and power-supply circuitry are housed in a group of air-conditioned cabinets and are fully duplicated. The stand-by channel may be run and tested into a dummy load without disturbing operations and complete built-in test facilities allow a detailed daily check of the whole system in ten minutes. The feed to the aerial reflectors for both azimuth and elevation scans is through 209 dipoles fed from a variable-width waveguide controlled by a motor and cam drive. The beams are thus swept over the required arc without movement of the aerial and a linear scan with uniform illumination is achieved.

BLOODHOUND AND THUNDERBIRD guided weapons are here the subjects of a presentation and a visitation. The top picture shows Mr. Sebastian de Ferranti (right) receiving a model Bloodhound, made by Ferranti's Apprentices Association at Wythenshawe (Manchester), from its chairman, Mr. A. Stobbs (centre). Others in the group, l. to r., are Dr. N. Searby, W. Clarke and Bryan Lees. The second picture shows Mr. Aubrey Jones, Minister of Supply (third from right) being greeted at English Electric's guided weapons division, Stevenage, Herts, by Mr. H. G. Nelson, managing director of English Electric. On the Minister's right is Sir George Nelson, chairman, and on the right of the picture Sir Conrad Collier, chief executive of the G.W. Division. The Minister saw Thunderbird Mk 1s



***DAILY COMET:** The regular daily B.O.A.C. Comet 4 service from London to New York was inaugurated by G-APDE on November 14, as seen here. The day before, G-APDB had operated eastbound the first Comet service since the original weekly schedule was halted on October 13 by a labour dispute*

Both aerials are the same size, different cams being used to sweep an azimuth arc of 20 deg and elevation arc of 7 deg. A continuous check on operation is provided by producing angle markers directly from a linear variometer driven by the mechanical sweep-drive. The single transmitter serves both elevation and azimuth scans operating twice through each aerial every second. Quarter-wave plates may be placed in front of each aerial to help in overcoming rain clutter, but M.T.I. is not considered necessary or desirable.

The controller sits at a console in which two 17in scopes are mounted to present azimuth and elevation scans. Although the range scales, from ten miles downwards, are non-linear the centre-line and glide-path appear as straight lines. Because the azimuth scan is equally distributed either side of the centreline, the equipment may be turned to cover a number of approaches and nearly all the installations so far envisaged incorporate a turntable system. The azimuth aerial of the R.A.F. caravan installation can be electrically tilted to lie flat above the elevation aerial and the whole vehicle can be electrically jacked up. Civilian installations are housed either in permanent or prefabricated buildings set up on remotely controlled turntables.

IN BRIEF

The Dutch Government Aviation School is to buy 18 Saab Safir 91Ds, at a cost of 3.8m guilder (about £360,000), to replace its Tiger Moths and Harvards. The school already operates some Safir 91As.

* * *

American interests are financing a company which is to build helicopters in Australia. It will be known as K. B. Brantly Helicopters (Australia) Pty. Ltd., and have two Australian directors. The first aircraft are expected to be marketed early in 1959. In America, the Brantly Helicopter Corporation is in production with the B-2 light helicopter, powered by a 162 h.p. Lycoming.

* * *

A bronze bust of Lord Hives (who retired from the Rolls-Royce chairmanship in January 1957 after 49 years with the company) has been placed in the entrance-hall of the Derby Works beside those of Sir Henry Royce and the Hon. C. S. Rolls. It is the work of Sir Charles Wheeler, president of the Royal Academy, and was on view during the Academy's summer exhibition.

* * *

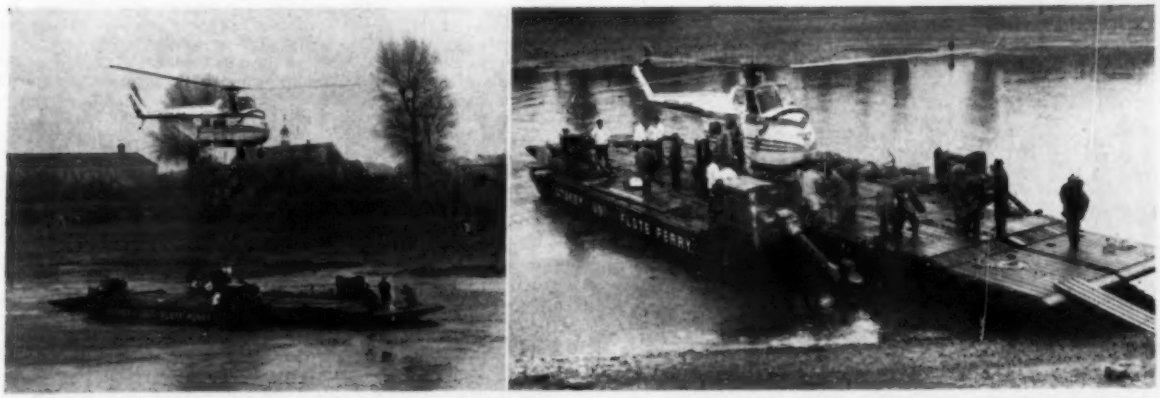
Twenty students of nine different nationalities registered recently at the Training Centre for Experimental Aerodynamics, Rhode-Saint-Genèse, Belgium, to take the one-year post-graduate course. They included two from the U.K., A. N. Dewar from the Royal College of Science and Technology, Glasgow (the first student to hold the Blackburn Scholarship endowed by Blackburn and General Aircraft, Ltd.), and P. J. Simpkins, who took a diploma in advanced technology at Northampton Polytechnic last year.

* * *

Avro Aircraft, Ltd., stated in Toronto last week that when the Arrow is Iroquois-powered "Canada could take the world speed record anytime she wanted." This statement followed recent Canadian reports that an Avro test pilot had reached 1,300 m.p.h. on a climb in a J75-powered Arrow. When the aircraft landed at Malton after this flight the brakes seized and damage was caused to the wheels and to a part of one undercarriage leg. This was the second time the Arrow has suffered a landing accident, a tyre having burst on touch-down at Malton on June 11.

***LEBANESE HUNTERS:** Colonel Boustani (left), director of the Lebanese Air Force, and U.S. Air Force Attaché Colonel Joseph C. Holbrook, U.S.A.F., with six Hawker Hunters just delivered to the Lebanese Air Force. The Hunters were purchased by the U.S.A. from Great Britain*

***GUEST OF HONOUR** at the London dinner of the D.H. Technical School Old Boys' Association on November 8 was Sir Alan Cobham (centre), seen here examining the souvenir album of the Association with the president Mr. J. L. P. Brodie (left) and the chairman J. M. Ramsden. Also present were Sir Vernon Brown, and Messrs. F. T. Hearle (founder of the School 30 years ago), R. E. Hardingham, Thurstan James, R. H. Bound and M. G. Ash*



***ONE OVER THE EYOT:** A Whirlwind flown by Westland pilot Roy Bradley making an unusual kind of deck landing. The craft—demonstrated on the Thames at Chiswick last week—is a Storey Uniflote, designed to assist civil and military bridge-building and comparable operations, or to be used as a landing-stage or ferry. Uniflotes are made by Thos. Storey (Engineers), Ltd., of 6 Victoria Street, London, S.W.1*

TABSO

ORGANIZATION AND EQUIPMENT OF BULGARIA'S STATE AIRLINE

By Clive Jenkins

TABSO'S current international route-network

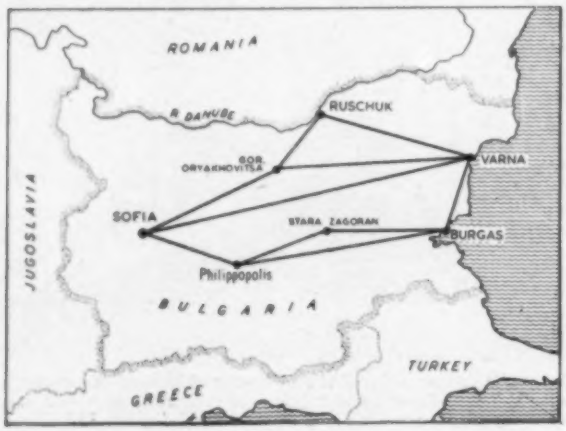
TABSO is the Bulgarian national airline. It was set up in 1947 as the Bulgarian-Soviet Transport Aviation Society and the initials are those of its original title. Within Bulgaria it is now known as the "Management of the Bulgarian Civil Air Transport" as the Soviet interest was withdrawn in 1954.

In view of its rather limited rôle within a predominantly agricultural country its political and administrative structure varies considerably from the pattern set by Aeroflot. TABSO has a head of management responsible to the Minister of Communications. He does not possess ministerial status himself (as in Aeroflot) but is a member of the "Collegium of Enterprise Chiefs" which is an internal policy-making body within the Ministry. The policy chief, as far as TABSO is concerned, is one of the Deputy Ministers of Transport and Communications. The head of Management is General Kiril Kirilov and his deputy is Georgi Avramow. Under their control are the heads of departments, i.e., commercial, flying (pilots and crews only), technical (engineering, small defects maintenance, inspection and quality control), communications and supplies. There are also two small sections dealing with meteorological services, and a "Notam" organization. The major maintenance shop is run as a separate enterprise within TABSO and responsibility for it is shared by the chief engineer and the head of the "Control Service" which is largely concerned with inspection and quality.

The airline has a total staff of 600 persons in all grades: 376 are at Sofia Airport, where all the major maintenance is done. Entirely derived from Soviet sources, the fleet consists of five Il-14s and nine Li-2s. There are also a number of An-2s and Po-2s, which TABSO provides for agricultural work. Until the Il-14s were obtained in 1957 all the services were run with Li-2s. Both types of aircraft are now said to be obtaining very high utilizations. TABSO has an average load-factor (taking both passengers and freight together), of 92 per cent, and the aircraft are extremely hardworked, particularly on the holiday routes to the Black Sea Coast. This means that only one can ever be under major maintenance at any one time. In 1950 22,820 passengers were carried, with 260 metric tons of freight. By 1957 the figures had risen to 90,600 passengers and 1,190 metric tons of freight.

Like all other airlines, that of Bulgaria has a peaking problem. This rises to a maximum of 550 passengers carried in the busiest days of June and July—with 20 services leaving Sofia, mainly for the popular and rapidly developing Black Sea holiday resort of Varna—and falls to 150 in the winter months. The commercial department have recently been giving special attention to the problem of fares in order to even out the amount of traffic carried throughout the year. At the moment the first-class train fare Sofia-Varna is 113 leva* while the air fare is 111 leva. It is understood that consideration is being given to further reducing the fare in the winter time. This will probably take place next year. No overhead costs are incurred for meals or refreshments served in the air; internal sector-lengths are so short that there is no provision made for cabin service.

The Bulgarian line's domestic services



TABSO has a number of international routes to Moscow, Bucharest, Budapest, Prague, Warsaw, Belgrade, Vienna and Berlin. The national airlines of these countries fly reciprocally. Bilateral agreements have also been negotiated with Belgium and Scandinavia while another is in process of negotiation with Austria. The only Western airline to fly to Sofia is K.L.M. and the Bulgarians recognize that the possibility of bilateral agreement with the U.K. is unreal in view of their lack of equipment and the present trade stalemate arising out of Bulgaria's lack of hard currency and inability to obtain credits.

The Minister of Communications delegates to TABSO the responsibility for building airfields (only Sofia has a concrete runway; the others are grass), maintaining them and also administering air traffic control. "We do not have plans for any new airfields," I was told by Rostislav Blaskov, chief of the commercial department of TABSO, "at this point in time the services we operate are adequately served from our existing airports and TABSO is adequately fulfilling its tasks within the framework of the country's economy." Mr. Blaskov has only held this post since July: before that he was a senior official in the Ministry of Communications.

In spite of the official attitude some Bulgarian towns are agitating for airfields to be built, but their case is not yet thought to be strong enough. The attitude of the management towards I.C.A.O. recommendations is that they abide by most of them and generally intend to conform with those standards.

The airline, unlike that of the Soviet Union, has no responsibility for educating the children of its personnel, but it is required to provide houses. I queried the size and scope of training programmes and found that these were mainly simple on-the-job programmes carried out in the winter by a body of lecturers. The pupils then sit an internal examination and receive certificates if successful. Most of the staff have, of course, come from the military technical schools; and this also applies to the aircrew, so the TABSO activities are limited to refresher courses—which do not, however, include Link instruction or simulated flight.

The pay differential between the mechanics and pilots seems to be less in Bulgaria than anywhere else. The average mechanic's pay for 46 hours weekly, spread over six days, is 850 leva per month, while the average pilot will earn 1,800 leva rising to as much as 2,000 in the summer time for an annual maximum of 600 hours.

TABSO is a subsidized non-profit-making State institution which makes an operational surplus but requires a subsidy for airfields, communications and low fares. This subsidy has been running at the rate of 30 million leva annually but was reduced in 1958 at the request of the airline management by 1,600,000 leva. It is financed by the Ministry of Communications and capital is provided interest-free although there is provision for taxation of the surplus.

The engine shop deals with the maintenance of the ASh-82T engines which are now on a trial life of 850 hours. I contrasted this with the life that we heard of in Kiev in 1958 for the Chezhov-82 engine, which was then 600 hours. The technicians at Sofia pointed out that it was a different engine (manufactured in Eastern Germany) and that the Soviet engine, according to the

**The bank rate of exchange is 19 levas = £1.*

latest factory bulletin from the U.S.S.R., has also had its life raised to 850 hours.

Sofia Airport is managed by a "chief of air stations" who is an ex-pilot. His title is deliberately based upon that of the "chief of railway stations" and he is responsible for the despatchers, communications, passenger handling, catering and air-traffic control. He has a maximum of 680 passengers to handle in any one day in the summer time (by TABSO aircraft only) of which 450 would be on the internal routes and 230 would be on the international aircraft. (Curiously, foreigners on internal routes have to show their passports before boarding while Bulgarians all produce their identity cards.) Passengers normally check into a town terminal and Czech or Hungarian-made buses take them to the airports on a non-fare-paying basis. I was informed that there is a five-year plan in existence for the airline which envisages a 60 per cent rise in freight and passengers within this period from 1957, together with the acquisition of up to ten new aircraft, although the plan has not said whether they are to have two or four engines. It was mentioned in passing that TABSO were interested in Viscounts and had, in fact, received informal approaches from Vickers, but the basic problem of currency and credits remained to be overcome. However, they were now carrying out an evaluation of the situation—which was, however, inhibited by the fact that they found it necessary to maintain a rather slower degree of expansion than they wished in order that air transport should not absorb an undue proportion of the national economic effort. TABSO runs a simple workmanlike operation which is completely frill-less.

PASSENGER'S VIEWPOINT

FLYING WITH TABSO

By K. Westcott Jones

BULGARIA'S State airline has carried very few Western passengers during the past decade. Quite recently, however, restrictions have been eased; a large State tourist organization, called Balkantourist, has been developed and has announced itself ready for foreign visitors.

Thus it came about that I found myself among the first group of British tourists to enter the country for nearly twenty years. Wishing to see Sofia—for so long a "forbidden European capital"—we had chartered a TABSO aircraft at £15 a head for the 300-mile flight from Varna, where we were assured by French-speaking officials that an Il-14 would be available to us.

A Balkantourist bus brought us—at 5.30 a.m.—to Varna's grass airport on the north side of the Lake of Varna, eight miles west of the city. No rain had fallen since the previous April and the earth was rock hard, covered only in patches by a sepia-coloured grass. On it stood two Li-2s (Soviet version of the DC-3) to take us to Sofia. An Il-14 was certainly at the airport, but it belonged to LOT (Polish Airlines), and was waiting to take an inclusive-tour party back to Warsaw.

With only one German-speaking official to guide us, we were split into two groups. The first aircraft away started its engines, with no one standing by with fire extinguishers. No fire-fighting equipment or tenders were anywhere to be seen at the airport.

Without first running-up his engines the pilot trundled the Li-2 to the end of the grass field and took off.

I boarded the second aircraft, LZ-TUA. Again there was no one standing by, and only the pilot was aboard. There was no co-pilot, steward or stewardess. Without a run-up, we, too, took off into the brightening sky.

The interior of LZ-TUA was in its original condition. Heavy soundproofing kept the engine noise to a low hum (quieter, I judged, than the noise level at the rear of the Britannia). There were 20 seats, of the deep and half-forgotten heavy-armchair type of immediate pre-war days. Most of the seat-belts were broken or missing, and no light warnings operated. There were six double units down the port side and six singles to starboard, with two single seats at the rear. The door to the flight deck was padlocked, with a heavy wooden stave across it. The toilet was in a filthy condition, filled with empty boxes and the remains of high-smelling sandwiches; none of the sixteen passengers was able to use it.

Nevertheless, it was a smooth and uneventful flight, and after 1 hr 55 min we came in to land at Sofia Airport. Wheels were put down with a bump as we sailed in low over trees. There was no margin for error, but all went well.

Sofia Airport has a large modern terminal building, adequate tarmac runways, and all the accustomed facilities. Its lounges have a heavy Victorian decor, with glass refreshment counters, big wooden benches, and giant chandeliers. The walls were decorated with mosaic maps and inscriptions to the glory of the Communist State of the People's Democratic Republic. Several large B.O.A.C., S.A.S. and Aeroflot posters were displayed below the ticket counters, but there was no sign of K.L.M.'s activities, although the Dutch airline has a weekly service through Sofia to Damascus. The airport is about five miles from TABSO's offices in the Narodno Sobranie Square, close to the centre of Sofia, where the airline bus service terminates. Particularly fine roads, empty of all but occasional buses, lorries, and a State taxi, permit fast access to the airport. The normal bus fare is 3 levas 20 stotinki (under 3s at the new tourist rate of exchange of 26 levas 25 stotinki to the pound).

My return journey differed from that of most of my companions. An Il-14 had arrived from Warsaw *via* Budapest and was bound for Varna with a few seats to spare. Waving my ticket, showing my Balkantourist pin, and juggling with languages ranging from Russian through French to English, I was allowed aboard. The aircraft was on a TABSO scheduled service, and was in excellent condition. Its registration was LZ-ILD, and it carried a crew of three. The 26 very comfortable seats were arranged in pairs, heavy curtains covered the windows but could be (and were) drawn and furled, a big brass clock stood on the starboard side of the forward bulkhead and there was an altimeter on the port side.

Most of the passengers were Poles or East Germans, with one or two Hungarians, bound for the new holiday resorts of Golden Sands and Varna Resort, where 20 new hotels overlooking the fine sands and warm waters of the Black Sea have been built by Swedish architects.

The flight was completed in 70 min, at a maximum altitude of 13,100ft. The Ilyushin landed comparatively smoothly on the grass field at Varna, and I waited there for more than half an hour to greet the Li-2 in which the less lucky members of the tourist party were returning.

A TABSO Il-14 at Sofia awaiting departure for Varna. (Right) The main lounge at Sofia, complete with chandelier and potted palms

SEASLUG

THE MOST MISSILE IN THE LEAST SPACE

By the Technical Editor

SINCE the development of a ship-to-air missile system for the Royal Navy began, many severe problems have been met and solved, and the resulting system is probably unsurpassed in effectiveness. Relatively few facts about it have been published, and this is an appropriate time to present an overall assessment of its history.

From its earliest days the project has rejoiced in the name of Seaslug. Nobody seems to know why, for the word does not accord with the later series of code-names in which weapon systems were identified by objects associated with colours.

Seaslug was first discussed shortly after World War 2, when a basic study into the problems of ship-to-air interception started at Westcott, which at that time was the Guided Projectiles Establishment. By September 1948 it was clear to Sir W. G. Armstrong Whitworth Aircraft, Ltd., that they would become deeply involved in the design, development and manufacture of the missile concerned. The company thereupon decided to set up an *ad hoc* division—since known as the armaments division—and to centre its work at the company's premises at Whitley. The managing director of A.W.A., Mr. H. M. Woodhams, took this decision, and was responsible for the formation of the division. He was also responsible for rebuilding the Whitley factory. At this time Mr. W. S. D. Lockwood, director and general manager, was works manager, and was responsible for the "ironmongery." Later in the programme there was a reorganization. Dr. Newman resigned from the company, Mr. Robertson retired from the position of staff administrative manager owing to ill-health, and Mr. G. T. White, chief planning engineer, was transferred to the armaments division as works manager, responsible to Mr. Lockwood, who subsequently became responsible to the managing director for the working of the whole division.

Mr. C. Bayly, who had become the recognized authority on solid-fuel motor design at I.C.I., was engaged as chief engineer and was actually responsible for the design of the Seaslug motor. In 1945 he transferred to Air Ministry Special Duties Branch and was attached to M.o.S. Armament Design Department, engaged on early design and development of monofuel and bifuel rocket motors. A year later he joined the Ministry of Supply as a Senior Scientific Officer and moved to Westcott. In 1947 he was attached to the staff of Lt-Gen. (now Sir John) Evetts, and went to Australia where he was engaged on the setting up of the Long Range Weapons Establishment and Woomera Range. In Australia he planned all range facilities of a technical nature, and later ran the test vehicles group responsible for assembly, testing and flight trials of guided weapons. He resigned from the M.o.S. in 1951 and became rocket motor design manager with I.C.I. at Summerfield Research Station, before joining A.W.A. in 1955. Mr. A. Lightbody joined the company from R.A.E. in 1948 as chief aerodynamicist, but was subsequently transferred to the armaments division and is now responsible to the chief engineer for all the technical effort. Mr. R. E. Young, chief of the electronics group, was one of the first to join the division.

Whitley was progressively reconstructed and enlarged, and this process has continued to the present time. A.W.A. received an instruction to proceed in collaboration with the General Electric Company and the Sperry Gyroscope Company, and this triumvirate has since led the Seaslug development programme.

All three companies had to build up a design staff from scratch. At the outset, Armstrong Whitworth decided to send a nucleus of staff to the G.W. division of the R.A.E. Farnborough, which was then the fountain-head of all missile knowledge in Britain. While Whitley continued with the task of reconstruction, installation of equipment and administration, the team of picked designers went to Farnborough on a five-month familiarization course so that they should learn to speak the language of the new field of missiles; at the same time a smaller team went to Westcott for a course on propulsion.

Many of the A.W.A. men who went on these courses are still with the company; in particular it is appropriate to mention the names of Mr. A. Lightbody, who is now technical director; Mr. L. Wookey, deputy head of the design department; Mr. J. M. Johnston, missile-design group leader; Mr. A. J. Sherwin, development-group group leader; Mr. H. Barnes, trials-group group leader; and Mr. G. Shipman, trials deputy group leader.

A design team nucleus had been formed at Whitley and an assessment and study programme got under way. In addition, the assembly and testing of a substantial number of RTV-1 tandem-boosted test vehicles was undertaken under contract to the R.A.E. to gain experience of system-testing and flight-trial techniques. At the same time Sperry's engineers got to grips with the problems of flight control, and a further team at G.E.C. began to

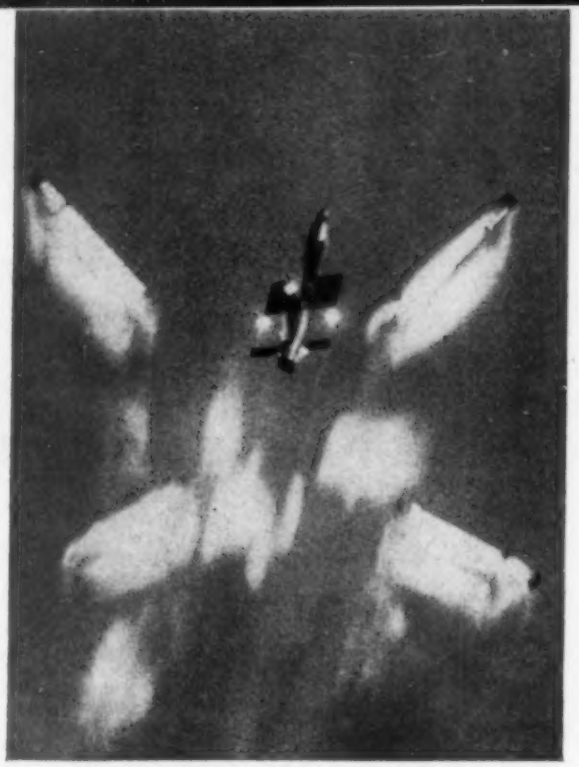


Fig. 1. Separation of Seaslug's four boost motors. The control and guidance system comes into action automatically at this point

Fig. 2. The control-fin assembly of a Seaslug test vehicle mounted on a test stand. Various test leads can be seen plugged into the unit and the nozzle of the rocket motor is clearly visible, joined to the sustainer charge via a blast tube. Seaslug controls are produced by Sperry

THE A.W.A SEASLUG

Already fired under service conditions, the A.W.A. Seaslug is the Royal Navy's first ship-to-air missile. Powered by a sustainer motor and four boosts, the Seaslug engages bombers at any height up to the maximum at which modern aircraft can fly. It is fired at individual aircraft selected by long-range radar and the firing crew is far smaller than the crew of a gun turret in a major warship. The first ships of the Royal Navy to be equipped with the Seaslug are four County class fleet escorts, which are on order. The trial ship, H.M.S. "Girdle Ness", is now in service and has already carried out many successful firings at sea. The Seaslug has been designed, developed and constructed by Sir W. G. Armstrong Whitworth Aircraft Ltd., pioneers in guided missiles, in collaboration with the General Electric Co., Ltd. and the Sperry Gyroscope Co., Ltd.

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD., BAGINTON, COVENTRY

MEMBER OF HAWKER SIDDELEY / ONE OF THE WORLD'S INDUSTRIAL LEADERS

C

A new way with Pipes,

The illustration is shown by courtesy of Rolls Royce Limited

elbows, ducts and valves

Wilmot Breeden, interested in the manipulation of metal in the cold state, have developed, in co-operation with famous jet engine firms, manufacturing methods for systems handling fluids at high and low temperatures.

Pipes, elbows, ducts valves and bearing housings are formed in nickel-chrome alloys in a succession of press operations from a flat blank. Other processes are rolling, spinning, welding, precision machining and high temperature brazing in atmosphere-controlled furnaces. The method allows for a high degree of accuracy and thus minimises leakage problems. Complex and varied formations can be quickly produced. Pipe bend radii can be kept small in relation to diameters without appreciable variation in wall thickness or change of section. Strict quality control is maintained by our radiological and metallurgical laboratories.

The illustration shows a typical component which forms part of the external anti-icing ducting of the Rolls Royce Conway engine. This system has metal spherical sealing faces and transmits air at elevated temperatures and pressures with a minimum of leakage.

If you have an application for this new method we should be pleased to investigate and advise.

Wilmot Breeden are skilled in metal manipulation

Wilmot Breeden Ltd., Birmingham

Fig. 3 (right). The Sperry electronic computer unit for the control system of one of the CTV test vehicles. Installed, it is completely sealed in a cylindrical case

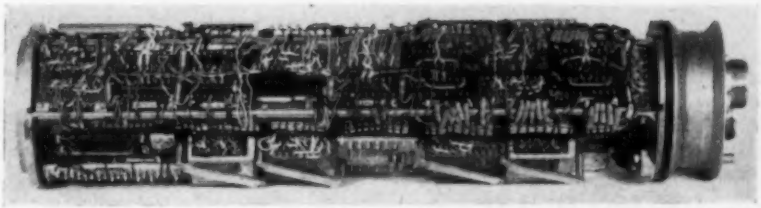


Fig. 4 (below). Guidance equipment employed for Seaslug trials. Like the computer unit, this complete package is sealed in airtight containers before installation

SEASLUG . . .

explore the vast field which comes under the general heading of "guidance."

After some six months, A.W.A. were in a position to start the detail design of a test vehicle. It was a requirement from the outset that one of the major aims in the design of the Seaslug missile should be to minimize the overall dimensional envelope, in order to permit stowage and easy handling of the greatest possible number of rounds in a fighting ship. Detail study showed that a particularly compact configuration would be to employ wrap-round boost motors mounted on the fore-body. Tunnel-testing showed that with such an arrangement it would be possible to stabilize the round during the boost phase by using the missile's own control fins in their zero (neutral) position. Such a layout meant that the control fins would be subjected to induced-flow effects from the boost motors, but the elimination of separate boost fins meant that the overall bulk could be cut to roughly one-quarter of that necessary for comparable weapons with rear-mounted boost motors.

Obviously, one of the first things to be done was to prove that the overall geometry of the missile and boost motors would work. Accordingly the initial design work was devoted to the separation test vehicle (STV), which consisted of an unpowered dart, roughly similar in size and shape to the missile ultimately envisaged, boosted by four pairs of motors. Except for these boost motors, the entire design and manufacture of the STVs was handled by A.W.A. at Whitley, and the first of a fair number was fired from what was then the Guided Weapons Trial Wing at Aberporth. This was the first full-scale test vehicle for a surface-to-air missile fired in Britain, and except for the STV which proved boost-separation for Fireflash, was the first vehicle with wrap-round boosts (and the first large round with multiple motors) to be fired anywhere. Right from the start the STV trials were successful, and the separation gear never failed. This was a promising beginning.

At the end of the STV programme a number of these rounds were sent out to the missile range at Woomera, South Australia. These rounds were fired there in order to assist in the development of the range itself and to provide working-up experience for the range staff and for the personnel of A.W.A. (Australia) who have since handled Seaslug firings on that continent.

The next step was to replace the STV by the controllable CTV. The first CTV was fired very early in the Seaslug programme, and a considerable number were launched during the subsequent two years. The CTV trials can conveniently be divided into three groups: aerodynamic configuration; autopilot plus moving controls (open- and closed-loop systems); and guidance (open-loop). After two years the CTV firings had built up a substantial background of aerodynamic control and guidance-system data, and both G.E.C. and Sperry were intimately involved in firings before the end of this period.

Sperry came in at the beginning of the Seaslug project with a background of extensive experience in automatic control systems for aircraft and gun-fire. A small nucleus of staff was built up into a team under Dr. F. Errington, now assistant chief engineer, under the overall direction of Mr. H. B. Sedgfield who is now engineering director; Seaslug project engineer is Mr. R. B. Ford. Engineering and laboratory facilities were progressively expanded, and elaborate environmental-test equipment was installed. Production facilities were also built up so that, as the project progressed, new designs were being fed in at one end as the previous batch of control equipment was being delivered.

Sperry have pointed out that the tolerances to which nearly all parts of the system must be manufactured are finer than would be allowable were the missile under the control of a human pilot. For example, an angular error of a tiny fraction of a degree in the position of the control fins could cause the missile to miss its target completely. In certain components, therefore, tolerances have to be held within from one to three ten-thousandths of an inch, and Sperry's coil-winding department has developed machines for winding potentiometers with wire finer than human hair. In Fig. 2 can be seen many of the major features associated with the hydraulic control ring at the rear of a Seaslug test vehicle. Down the centre passes the blast tube of the sustainer motor, and surrounding it is the control ring itself carrying the four control fins, each actuated by a hydraulic jack. Another item of

Fig. 5 (right). The TP-1 iso-propyl nitrate gas generator: 1, cordite charge; 2, igniter; 3, combustion chamber; 4, coupled piston assembly; 5, pressurized coolant; 6, pressurized fuel; 7 and 8, isolating valves; 9, control piston; 10, swirl atomizer; 11, coolant atomizer; 12, safety disc; 13, delivery pipe

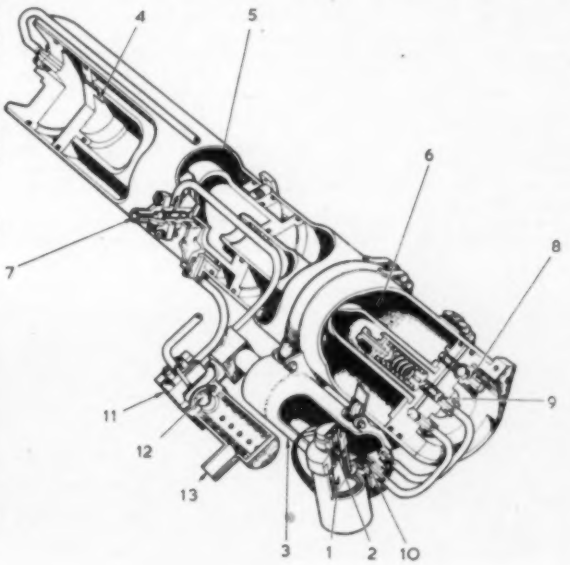
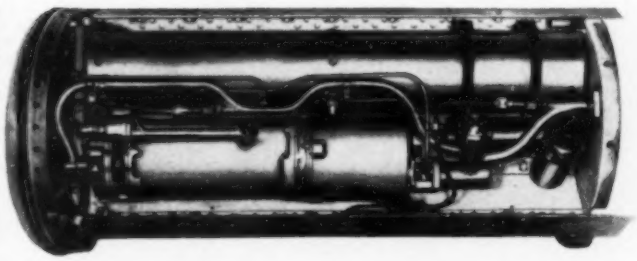


Fig. 6 (below). A missile installation of an iso-propyl nitrate gas generator and turbo-alternator



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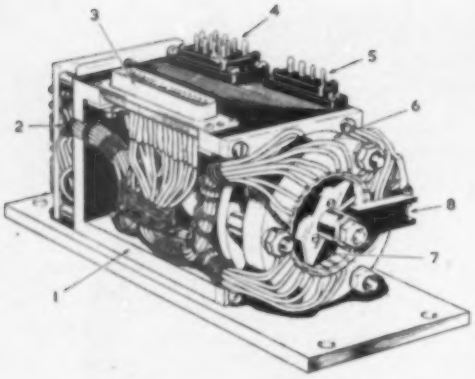

Fig. 7. The high-speed sampling switch: 1, rigid frame; 2, printed - circuit cathode follower unit; 3, channel inputs; 4 and 5, power-supply sockets; 6, double commutator; 7, rotor housing and sampling brushes; 8, slip ring and brush assembly

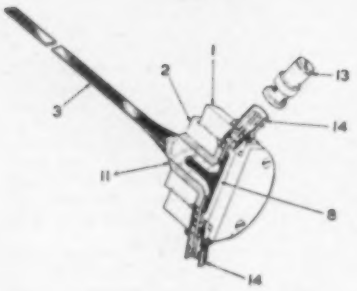

Fig. 8. The spike aerial: 1, light-alloy base; 2, housing plug; 3, aerial blade, 8, p.t.f.e. collet and insulating cap; 11, insulating collet assembly; 13, matching stub connector; 14, cable connectors

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Sperry equipment is the electronic computer unit shown in Fig. 3, the obvious difficulties of the design of which are rendered more acute by the fact that the launching acceleration can exceed 40g.

It is not permissible at this stage to discuss the guidance and control systems in any detail, nor even to state what type of guidance is employed. It is, however, clear that the system includes a large and powerful ship-borne radar, and there appear to be two main scanners above the bridge of *Girdleness* (the trials ship, which will shortly be described).

One of the packages of airborne guidance used during the CTV experiments is shown in Fig. 4. It is clear from the geometry of the package that it occupies approximately a 120-deg segment of the Seaslug body. This could lead one to suppose that the relevant portion of the body is divided into three roughly equal 120-deg compartments housing guidance, controls and, perhaps, accessories. Fig. 4 shows an early guidance package with the covers removed, revealing two cylindrical main sub-assemblies which apparently are sealed by rubber rings in compression when the covers are put on and tightened up. Fig. 11 (p. 793) is the first to reveal the guidance equipment used in Seaslug at the present time. All sub-units are potted in resin and the whole system is housed in a very strong pressurized container. Finally, Fig. 12 illustrates a new package, lighter, more robust, and with lower power consumption, which may be used in future. All this equipment has been produced by G.E.C.

Research director for G.E.C. is Mr. O. W. Humphries; the Applied Electronics Laboratories (at Stanmore, Coventry and in South Australia) are managed by Mr. R. J. Clayton and the Seaslug project engineers are Messrs. J. M. C. Pinkham and H. A. Macdonald.

In order to bring to life the various airborne systems of the Seaslug, A.W.A. expended much effort in the a.p.u. field. From the outset it was decided to drive an alternator and hydraulic pump by a turbine fed either with bottle-stored air or with hot gas from the combustion of a suitable material in a gas generator. It was finally decided to employ a gas generator, and the initial design employed a cigarette-burning charge of cordite housed in a steel breech-tube provided with a filter and discharge pipe to the turbine. It was found that cool-burning cordite produced large quantities of finely divided carbon, and accordingly an improved design was evolved in which hot-burning cordite (which yielded relatively clean products of combustion) generated gas at a very high temperature, which was then cooled by a mixture of water and methanol expelled from a cylinder by a differential piston.

This type of gas generator (described in our issue of September 13, 1957) has given trouble-free service over a large number of flight trials. Nevertheless, A.W.A. continued their investigations and found that a strong case could be made for the employment of iso-propyl nitrate as a mono-propellant. The TP-1 power unit operates in the manner described in the caption to Fig. 5; the complete unit is shown associated with a turbo-alternator in a missile installation in Fig. 6. It was found that the i.p.n. unit was half as heavy and half as bulky as its cordite counterpart. Future work is being directed towards the design of an integrated package combining gas generator, alternator and oil pump.

It is perhaps appropriate at this stage to interject comments on the telemetering of data during flight trials. Such procedures had scarcely been attempted before the era of guided weapons, and A.W.A. had to develop a considerable amount of equipment from scratch. In particular, the company evolved a high-speed rotary sampling switch and a matched spike aerial, both of which have been supplied for other missile programmes and for the Skylark I.G.Y. rockets. Based on a design by the Signals Research and Development Establishment, Christchurch, the sampling switch is employed for time-multiplexing and in its most common form has two commutator banks each having 24 segments which can be sampled at between 100 and 220 revolutions per second. An indication of the function of the switch is given in the caption to Fig. 7. When the switch is rotating, the commutator brushes are loaded against the channel segments by centrifugal force, a small rubber buffer being interposed between the brush and a weight selected for the desired speed range; thus there is no guaranteed brush/segment contact when the switch is stationary. Much of the good performance of the switch, particularly the absence of "broken" channels, stems from the very high surface-finish given to the commutator.

Also associated with Seaslug telemetering is the spike aerial shown in Fig. 8. A.W.A. have pointed out that although the chief problems here were electrical, including a requirement to keep the standing-wave ratio as near unity as possible, equally stringent demands had to be met in order to minimize drag and provide maximum strength in order to withstand the aerodynamic forces set up during controlled flight. Stub matching is employed to obtain standing-wave ratios better than 1.5 over a band-width of 30 Mc/s at a nominal frequency of 460 Mc/s. At the working frequency the standing-wave ratio is less than 1.1. Construction of the spike aerial is apparent from the key to the illustration. Usually the spikes are mounted on the main body of the missile, normal to the major axis. It was found convenient, particularly from the viewpoint of manufacture, to utilize a standard R.F. co-axial connector plug as a matching stub (13 in the key), the end of the centre contactor being connected to the outer through a short-circuiting disc. The result is a sealed and completely screened assembly, from which the aerial blade can be removed for transport purposes without disturbance to the feeder system.

The next major undertaking was to develop a sustainer motor, for which purpose the MTV (motor test vehicle) was designed. It was an original requirement that a liquid-propellant unit should be used, operating on nitric acid and methanol, the latter being scheduled to give way to kerosine at a later date.

The first of the large number of MTVs differed from previous test vehicles in having four packets of triple boost motors, making a total of twelve in contrast to the eight previously employed. By this time a complete test-bed installation had been designed and developed at Whitley, and the complete propulsion system

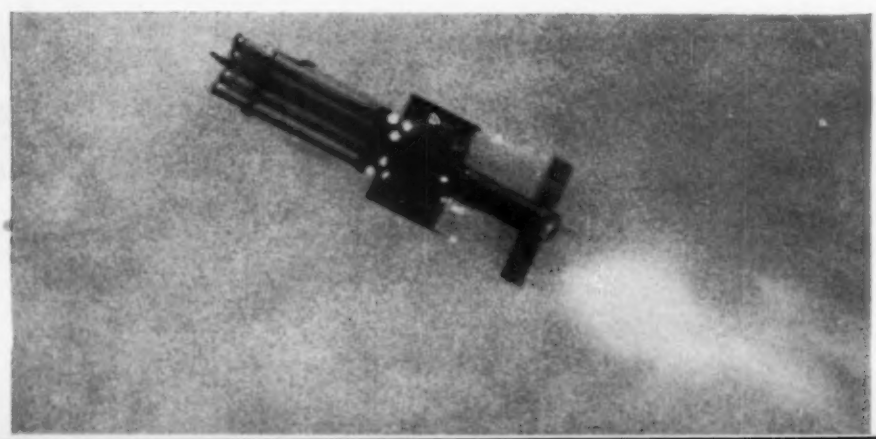


Fig. 9. A Seaslug MTV during the boost phase. The triple packages of motors are evident

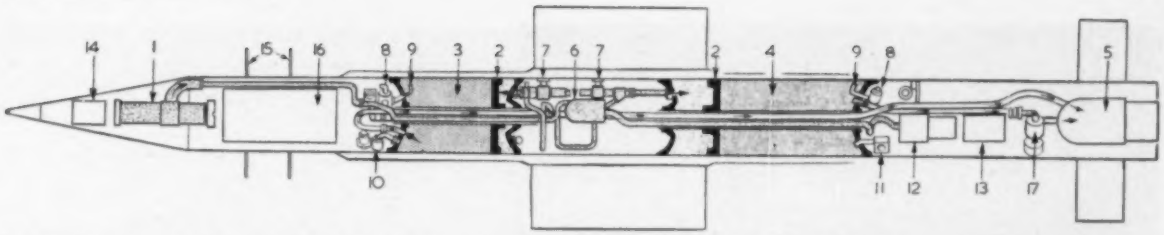


Fig. 10. This schematic diagram of a liquid-propellant Seaslug MTV was prepared from an exhibit displayed by Armstrong Whitworth Aircraft in 1957: 1, gas generator; 2, propellant-tank free pistons; 3, fuel (methanol); 4, oxidant (nitric acid); 5, combustion chamber; 6, gas filter; 7, gas relief valves; 8, vent valves; 9, vents; 10, methanol filling; 11, acid filling; 12, turbo-alternator; 13, alternator control; 14, accelerometer group; 15, aerials; 16, guidance system; 17, servo filter

was tested there. The propellants were contained within the missile body and expelled by movement of pistons under the pressure of cordite gas from a generator. An MTV is illustrated in Fig. 9, and functioning is depicted in Fig. 10.

Initial MTV trials were concerned with boost-phase separation and the general aerodynamics of the triple-boost system, and it was also found necessary to cure a small aero-elastic problem (the first ever encountered on Seaslug) which affected the control fins. Then came firing trials of the sustainer itself, and it was found that high-frequency vibration during flight caused a breakdown of the cooling film around the regeneratively cooled chamber, leading to structural failure of the latter. This problem, very

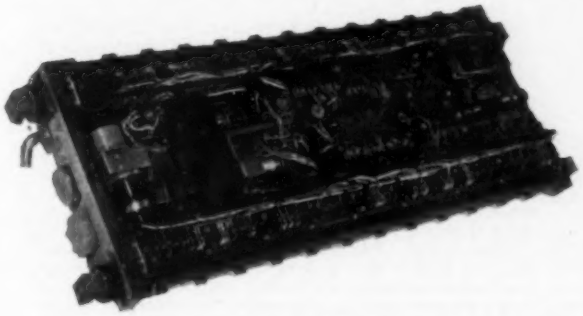
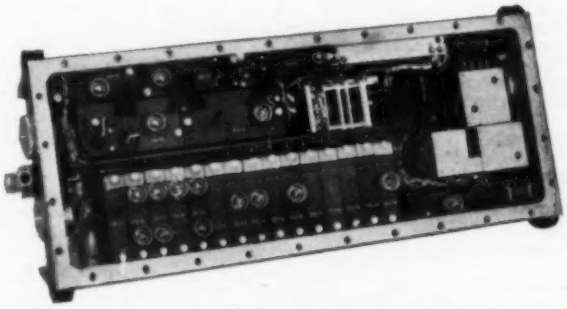


Fig. 11 (above). Guidance equipment currently used in Seaslug. The equipment is housed in an airtight container with multiple-bolt attachments for the lid. The complete system is produced by G.E.C.

Fig. 12 (below). An experimental model of an advanced guidance equipment based on the use of transistors and printed circuits. It is expected that similar equipment might be introduced into the Seaslug



difficult to simulate on the ground, was eventually cured by modifying the design of the chamber. It was, however, necessary to continue the control and guidance experiments with rounds devoid of a sustainer.

Prior to all this, Imperial Chemical Industries were asked to explore the possibilities of producing a solid-fuel sustainer motor for Seaslug, and joint discussions began roughly six months later. It was calculated that a missile of comparable performance could be evolved with a solid motor, but a remarkable period was to elapse before a final choice was made. It was appreciated that the solid sustainer required would be extremely large in comparison with any previously developed, and that it would not be an easy task to make it reliable and prove its superiority to a liquid system. Nevertheless, the fact that Seaslug was intended for use against attacking aircraft implied instant readiness at all times, and it has never been easy to achieve this in a liquid-rocket system. A.W.A. were particularly concerned at the "shelf life" of tanks holding the concentrated nitric acid—which could constitute a hazard, particularly on a ship at sea. In the event, they have now had tanks full of the acid for periods in excess of three years, and one has just been stripped after three years and five months (possibly a world record).

When the various parts had all been proven, A.W.A., G.E.C., Sperry and their supporting firms were ready to start the manufacture of prototype rounds of the operational weapon. In that year it was decided to eliminate the liquid system, and manufacture started on the series of prototype Seaslugs fitted with solid sustainers.

A major design change was the introduction of a new and much larger boost motor, and the fact that only four of these were needed meant that the whole process of boost separation had to be run through again. The first prototype was fired on the test-bed at Whitley; I.C.I. had previously done static firings of the motor at Kidderminster, but the M.o.S. wanted a bench test of the whole airframe to prove such factors as gas leakage and compatibility of components. The usual sequence of trials was then followed, leading up to the successful mission of a fully guided operational-type round. A very considerable number have been fired since.

It is appropriate at this point to emphasize that the missile itself is but a part of the overall Seaslug weapon system. Co-ordination of the development of the missile has always been the responsibility of the Ministry of Supply. The Admiralty retained control of the shipborne equipment, including storage and handling systems, launcher and radar.

One of the first pieces of equipment to support the shipboard gear was the Clausen rolling platform (*Flight*, November 2, 1956) which consists of a large floating platform capable of being constrained mechanically to pitch and roll like a ship at sea (motion can be imparted to simulate any desired vessel in any sea state)

Fig. 13. Seaslug first went to sea aboard H.M.S. "Girdleness," a converted Liberty-ship which mounts a triple launcher on the foredeck together with all the shipboard guidance, storage and handling systems

Fig. 14. The artist's impression above is the first to give an indication of the configuration of the forthcoming County Class of guided missile cruisers. Classed as super-destroyers, they will carry a triple Seaslug launcher aft

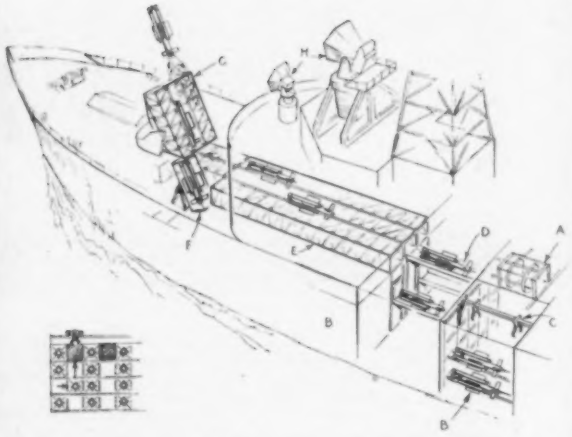


Fig. 15. An indication of the shipboard handling system: A, check-out and test; B, magazines (shown in cross section in the small inset); C, hoist to railed system; D, hydraulic lift; E, three rail systems; F, tilting loading cradle; G, triple launcher; H, radar. The installation depicted is hypothetical

SEASLUG . . .

and carrying a complete Seaslug radar and interlinked launcher. For various reasons it was decided not to employ zero-length launching, but to fire the Seaslug from a railed system picking up each of the boost motors. This has been found necessary in order to provide the positive control at the moment of firing so essential during operations in rough seas. During the early launchings at Aberporth and Woomera single launchers were employed, but the Royal Navy have decided to employ a triple launcher in which three rounds are carried in a rigid lattice-work frame, all three rounds being pointed in the same direction and capable of being fired in salvo. The entire system, including the triple launcher, was first installed on the Clausen rolling platform.

Seaslug first went to sea aboard H.M.S. *Girdleness* (Fig. 13). This 8,000 ton vessel, which was commissioned in April 1957, is a converted Liberty-ship, and is thus large enough to accommodate a complete Seaslug system together with extensive laboratories and accommodation for special test crews and representatives of the contracting companies. Firings from *Girdleness* have been going on since the summer of 1957, both in home waters and overseas. It could be argued that Seaslug is the first British guided missile for operational service to be tested under representative operational conditions. Rounds have been fired over a wide range of sea states, and in all weathers, and only about four or five civilians remain on board "to look over the Navy's shoulder."

At present four operational craft are scheduled to be armed with Seaslug. Known as the County Class, they will bear the names of four of the famous series of former County Class cruisers: *Hampshire*, *London*, *Devonshire* and *Kent*. Possibly to be classed as a super-destroyer, each will obviously have a displacement of more than 4,000 tons and will be large enough —Fig. 14—to set a new standard of accommodation and seaworthiness. The entire ship will be air-conditioned and capable of operation in fall-out areas during atomic attack. Gun armament forward will comprise A and B turrets each mounting two high-angle, rapid-firing, dual-purpose guns (presumably of 4.5in calibre) and a triple Seaslug launcher and associated radar will be mounted aft. All four ships are due to commission in about two years' time.

Rounds will be stored in special magazines occupying a substantial proportion of the overall interior of the hull. Each missile will be retained in its boosted and fully operational condition and will be mounted horizontally on a magazine trolley stacked on a superimposed rail system. It will be possible to select any round and traverse it sideways hydraulically beneath a crane which will lift the round into a longitudinal rail transport system. Choice of round will presumably depend upon serviceability and possibly on the type of warhead required. (Nothing has been said officially about whether or not Seaslug can have a nuclear warhead, but it has been stated that future versions of Bloodhound and Thunderbird will have a choice of H.E. or nuclear.)

Seaslug will ride in the magazine located by anchorages in the four boost motors. The trolley will be moved sideways by a ram and chain system, and, after the round has been picked up by the longitudinal conveyor, the trolley will be left behind and returned to its stowed position. The longitudinal transport system comprises four rails locating each of the boost motors, movement being imparted to the round by chain rammers engaging feet on either top or bottom boosts.

A single traverser will be incorporated in order to move rounds from one rail to another and into a special check-room for testing purposes. Control points throughout the ship will enable men to operate the various levers and buttons controlling the magazine trolleys and traversers. A triple launcher will, of course, involve a triple rail system, and at the forward end of the three quadruple rails a tilting loading cradle must be incorporated in which rounds can be rotated upwards to match the angle of the launcher. Finally powerful rammers will feed the rounds out of the loading cradle and up into the launcher in one operation. Fig. 15, which is based on the hypothetical H.M.S. *Successful* exhibited at the S.B.A.C. Show this year, gives an indication of how the system will look.

Girdleness has now fired a large number of Seaslugs against a variety of targets, including both Firefly U.8s and more advanced targets capable of higher speeds and altitudes. Practically all of these have been successfully destroyed both from ship and shore bases; on more than one occasion, of two rounds fired the first has hit the target and the second has struck the largest remaining piece of wreckage. One could hardly expect a higher standard of performance than this.

FATIGUE INFORMATION

A FIRST group of 20 *Fatigue Data Sheets* has been published by the Royal Aeronautical Society's technical department. They represent the culmination of many years' study of the problem of structural fatigue by the R.Ae.S. structures committee and (since 1955) by the fatigue committee formed specially for this work. In addition a number of specialists from industry, the research establishments and the universities have been consulted. Thus the results of research reports and experimental work have been brought together to provide reliable numerical data.

The data sheets, which will be subject to constant review and extension, are available from the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, at £2 6s per set (this price applying to both members and non-members).

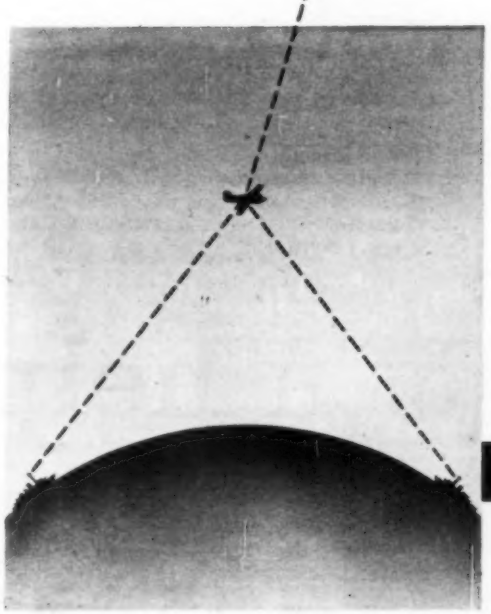
GARRETT APPOINTMENTS

TWO appointments to the foreign operations department of the Garrett Corporation have recently been announced. Mr. Robert W. Morris, M.I.M.E., A.F.R.Ae.S., has become manager and Mr. Pierre DuFay the European engineering representative.

Mr. Morris has been with Lockheed Aircraft Corporation for the past nine years, specializing in pneumatic systems, and prior to that was an experimental officer with the R.A.E.

Until this new appointment to the Geneva office of the Garrett Corporation, Mr. DuFay had been senior development engineer at the AiResearch manufacturing division in Arizona. He has been with the Corporation since 1954; previously he had been with Hispano Suiza.

A new Fairey Gannet extends the range of naval radar



Line-of-sight range limitations of early-warning radar will soon be overcome by the Fairey Gannet AEW Mk. 3, an airborne radar search and control centre for units of the Royal Navy.

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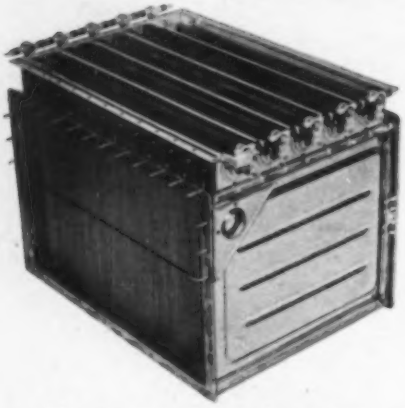
HEAT EXCHANGE



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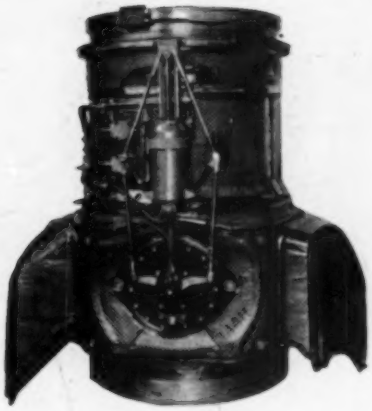
HEAT INSULATION



OUR THERMAL insulation blankets can be designed to fit *any* component, as this example shown fitted to the Rolls-Royce thrust reverser of the de Havilland Comet proves. They are also planned so as to be easily fitted and removed, to retain their shape throughout the life of the component and to give the maximum insulation compatible with their low weight of .65 lb per square foot.

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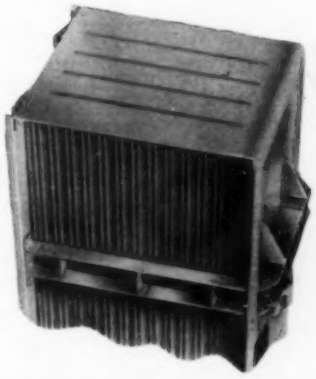

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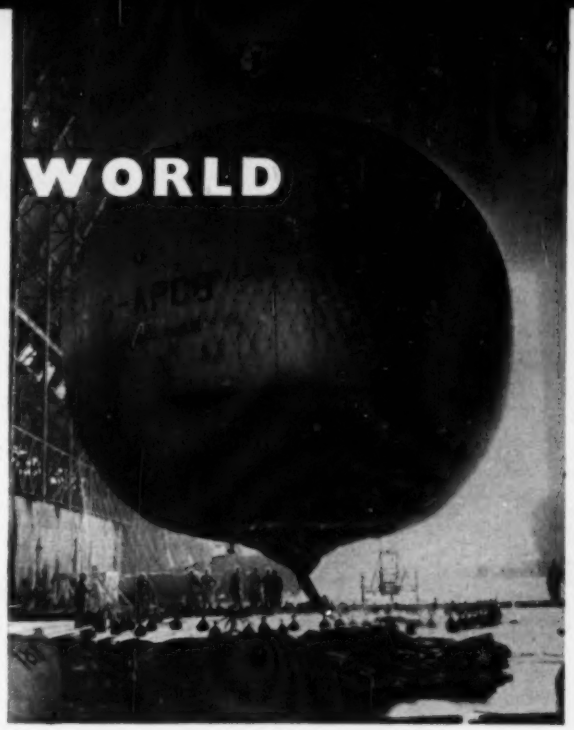
The jet that will go everywhere – and pay its way

THE SMALL WORLD

More about the Forthcoming Attempt to Cross the Atlantic by Balloon

BY COLIN MUDIE



A FORTNIGHT ago we gave news of a remarkable project for crossing the Atlantic by balloon. As we said at the time, the hazards have been so carefully assessed that the adventure—which has the patronage of the Duke of Edinburgh—cannot be regarded as a mere stunt. The crew will consist of Arnold "Bushy" Eliott (in command), Colin Mudie and his wife Rosemary, and Mr. Eliott's son Tim. The start is to be from Tenerife sometime after the end of this month. In this article, specially written for "Flight" by arrangement with the "Daily Mail," which has reported the project exclusively, Colin Mudie explains some of the problems involved and describes methods devised to meet them. He has been responsible for the design of much of the equipment and will act as navigator on the flight. "The Small World" is the name of the balloon, preparation of which is now in its final stages

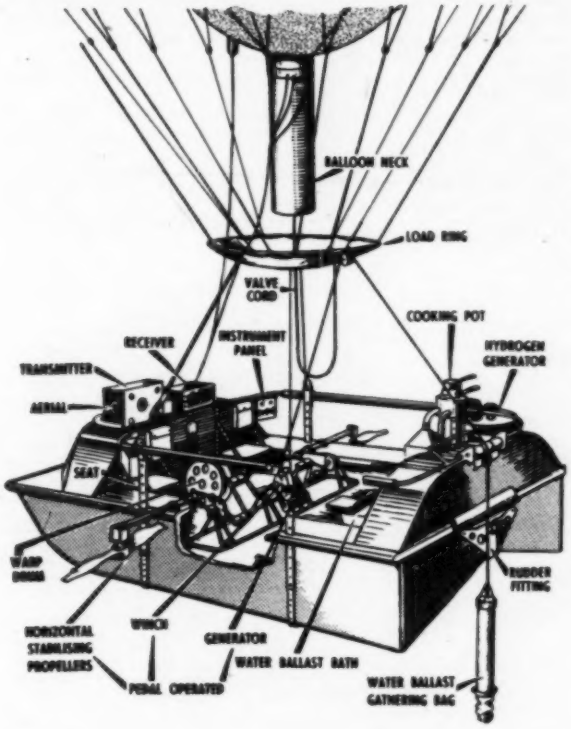
THE balloonist is concerned, in flight, with maintaining the vertical equilibrium of his craft. Directionally he is almost completely dependent on the wind system in which, by design or chance, he happens to be riding.

Equilibrium is established by exactly countering the out-of-balance forces which cause the balloon to rise or fall, by letting go an equal and opposite amount of gas or ballast. A few pounds of lift will cause the balloon to ascend; and equilibrium under ideal conditions is achieved by "valving" a few cubic feet of gas. Under normal ballooning conditions, however, the gas bag is sensitive to comparatively small barometric and temperature changes, and the pilot has also to contend with thermals and other natural vertical movements of air. Equilibrium, therefore, is a matter for constant attention and for considerable trimming of gas and ballast.

From this it can be seen that the amount of gas and ballast, equal and opposite, in excess of that required to carry the crew and their equipment is a measure of the power of the aerostat to stay in the air. It is power to counter out-of-balance conditions and, in this way, power can be related to flying time. There are also some constant losses due to the porosity of the gas bag, but these are of small effect when compared with the piloting losses.

The barometric and temperature changes in gas-bag lift are proportional to the size of the bag, so that any advantage to be gained from pure size is, as far as distance or endurance flights are concerned, nearly completely countered. Records, therefore, were made in the past by careful pilotage, for the balloonist who noticed and countered an out-of-balance condition quickly and exactly got farther than those who let the condition establish itself to the point where more correction, by ballast or valving, was required—with the possibility of over-correction and re-correction. Also, if a balloon is allowed to rise, the natural expansion of the gas in the reduced atmospheric pressure allows it to spill out of the neck, so producing a loss additional to that from the valving of gas to reduce lift.

The Small World expedition was planned from the beginning around the North-East Trades. For many reasons the Trade Winds became the crux of our proposed passage. The first thoughts of such a trip came during a small-boat passage in the Trades. The weather at certain times is equitable and—to a much greater extent than anywhere else—predictable. The winds, too, are usually of some strength, so that the time we would be required to stay in the air for a complete crossing might well be reduced to a reasonable amount. In addition, the survival conditions, should we be forced to land at sea, were within our experience and seemed reasonable. And, as had been remarked elsewhere, any expedition that finishes in the West Indies is worth-while anyway.



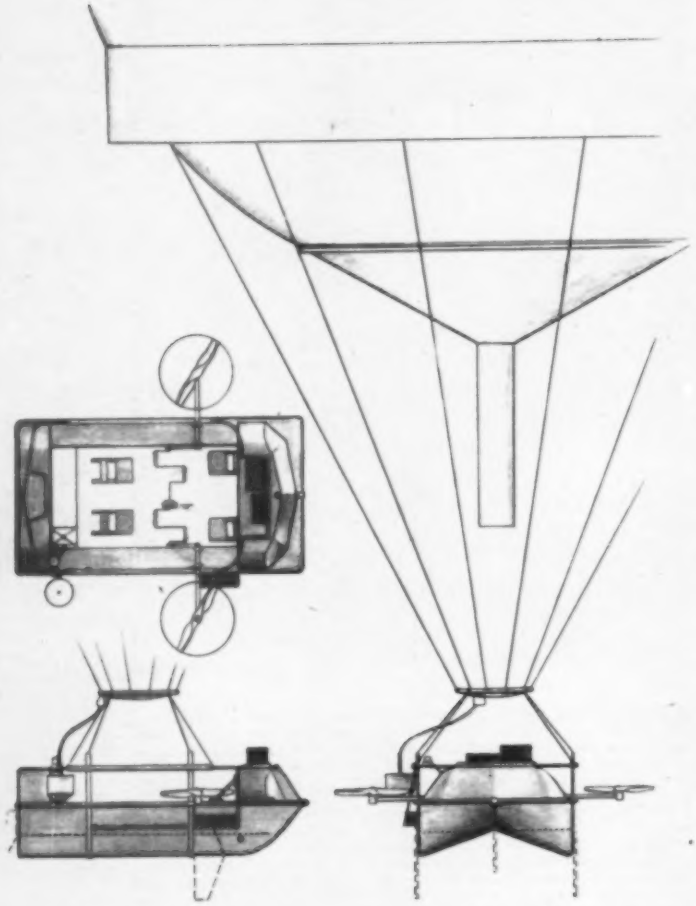
When the idea became more than an after-dinner-napkin trip we thought in our ignorance that the principal difficulties would be, first of all the porosity of the gas bag (which we thought might be overcome by taking advantage of modern fabric developments) and, secondly, the designing of a balloon car which would be at once light enough and yet sufficiently seaworthy to make an ocean passage of, perhaps, several thousand miles.

To these problems we produced answers which looked reasonable on paper; but in the meantime we discovered that the greatest difficulty would be the change of temperature of the gas between tropic day and tropic night. The difference between the two conditions would be of the order of ten per cent of the total lift available. This would mean, for instance, that if we had a gas bag with enough hydrogen to lift a weight of 3,000 lb we would have to valve 300 lb of lift on the first morning and let go 270 lb of ballast in the evening—and so on for every day, quite apart from the normal daily pilotage losses.

Our answer to this problem will be the deciding factor in our success or otherwise. We plan to fly at between 500ft and 1,000ft and to draw up ballast from the sea by means of specially designed water-gathering bags on the end of a Terylene warp and lifted up to the car by a four-man pedal-operated winch. By this means we expect to be able to pick up in one bag as much as 300 lb of water in one lift if it should be necessary. Our warps are 3,000ft long, which should provide sufficient reserve for emergency, and we should not have to pick up anything like 300 lb of ballast in one lift unless we have to ditch any heavy equipment in order to stay airborne.

[*Contd. overleaf*

An artist's impression of the boat/car with its major items of equipment. Above, the balloon undergoing leakage tests at Carlington. Assisting was W/C. R. S. Booth, the veteran airship captain, who will superintend the launching at Tenerife, in the Canary Islands



THE SMALL WORLD...

The balloon itself is of silver colour on top and black underneath, to slow the convection currents about the surface and thus to reduce the rate at which the heat-up or cool-down occurs —and therefore the rate at which ballast has to be gathered from the sea. A white "skirt" is to be hung around the balloon to keep the sun from the black area.

The next losses to be countered were the constant frittering-away of small amounts of gas or ballast which occurs in maintaining equilibrium. These were rarely, it seemed, of more than 20 lb or so at a time, and often only of the order of 10 lb. They were also usually due to a purely temporary out-of-balance condition, such as a thermal current or the veiling of the sun by cloud formation. Although small in degree, such losses would be a constant drain and over a period of days could amount to a respectable quantity. The pedals suggested power, and now we have a pair of small propellers mounted so that they can be driven to give us thrust either up or down. Striking about 45 r.p.m. on the pedals—an uphill gradient for two or a level fast ride for four—gives us about 25 lb of thrust, and maybe more.

In addition we have a hydrogen generator. A charge of calcium hydride is slaked with water and the hot hydrogen given off is piped first around our cooking pot and then into a water-cooled radiator before it goes into the bag. The radiator does in fact sit in a large bath which is used to hold the water ballast we pick up from the sea. Practically all our pure ballast will be in the form of calcium hydride charges, and this should enable us to turn five or six hundred pounds' weight of ballast into five or six hundred pounds of lift, giving a net flying-power gain equivalent to 1,000 lb.

These, then, are the tricks we rely on for an improvement on the long-distance ballooning record. If we could carry out our ballast-gathering and helicoptering perfectly there would be no reason why we should not stay aloft indefinitely. Obviously we shall not attain perfection, and our flying time ought to be proportional, always provided that nothing else goes wrong. As a second prop we can for some days replace the hydrogen we use. After that we start level with the balloonists who hold the official distance and duration records—respectively 2,766.814 km (1,719.4 miles) and 69 hr 20 min, by the Russian crew Nevernov and Gaiguerov in 1941.

Again to help us we have several devices which may be an improvement on earlier equipment. A barometric switch made for us by Bristol University switches on lights and buzzers if we vary more than 300ft from our predetermined mean height. It is meant principally as a second line of defence in case the watch on duty have their attention distracted. In addition we have an extremely sensitive altitude variometer of a type which has been used with great success in gliders, and an ultra-sensitive altimeter. Beyond these, of course, we have all the traditional balloonist's equipment, adapted where necessary for a flight over the sea. The trail rope, for instance, will give the least possible drag when it is in the sea, but will relieve the balloon of its own weight in the traditional manner.

So much for our flying power vertically. In direction the Trade Winds are estimated to blow us in a minimum time of eight days towards an arc-of-arrival extending from the gulf of Honduras to the Guineas. A 2,000-mile arc after a 2,700-mile passage would seem to be large, but the important factor is that it is all covered by the same wind system, and the risk of being blown into the Doldrums is very small. The Trades are not such constant winds as romance would have them, and ten-day calms and adverse winds have been experienced by a great many voyagers; but our time of departure is planned for both the best winds and the least number of electrical storms of the year.

The danger points of the flight are likely to be take-off and landing. A successful take-off will, we feel, be 95 per cent of the battle, and to help us we have gathered together the best launching crew we know. We have to wait until satisfactory weather conditions establish themselves, with a good wind to take us south-westerly until we are without doubt in the Trades. The balloon has to be inflated, in shelter if possible, and manœuvred to a launching site with the clearest run and least land turbulence on the way to the sea.

Landing (to use contradictory terminology) will probably be in the sea—in emergency, or through lack of gas, or by plan. The car is designed in boat form with a high-speed planing hull of sea-sledge type which has great directional stability. We plan to slow our speed over the water with drogues as we come down, but in any case there will be warps, trail ropes, emergency food bags and a mast dangling over the back of the car. These will ensure our landing with the hull pointing dead downwind, and the balloon can be released at once by a system of quick-release hooks. Then, with balloon jettisoned, we can rig mast and sail, rudder and leeboard, and sail on.

The car/boat is built of polystyrene foam covered in a coated Terylene impregnated with an epoxy resin. The whole is very light, is self righting, and has a positive buoyancy of about two tons. The hull is "soft" (i.e., without hard members as far as possible) and is suspended from the balloon by a system of metal straps and strong bars which take all the ballast and equipment loading off the marine structure. The hull itself is the product of a series of models and has proved, so far, to be quite satisfactory. Afloat and sailing it has a medieval air with its raking lateen sail, golden colour and high poop.

Should we alight in such conditions that it will be possible to keep our beautiful balloon we shall, of course, make every endeavour to do so; and to this end it has a much-larger-than-usual ripping panel. The fabric is a neoprene-coated Terylene of lighter weight than normal and of great strength, and is contained in a conventional net and rigging.

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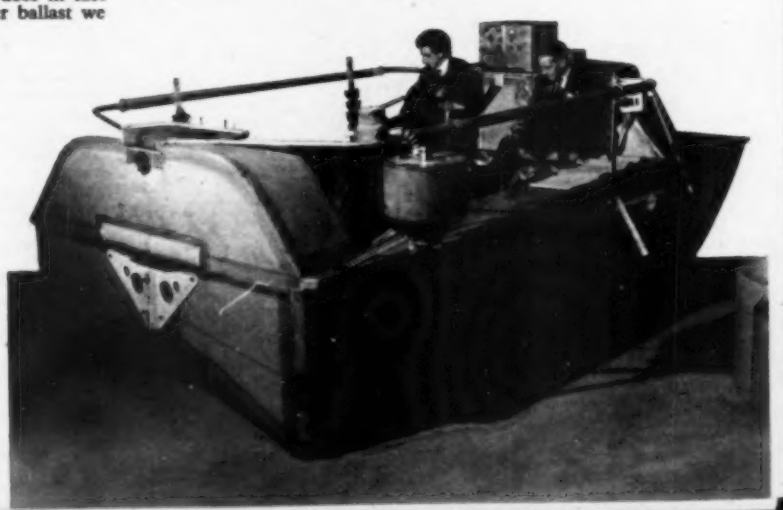


The partially completed car, with "Bushy" Eiloart and Colin Mudie (left) on board. The drawing above shows the general arrangement of the craft

Jet Provost Odyssey

DEMONSTRATION TOURS OF INDIA, PAKISTAN AND SOUTH AMERICA

THE Jet Provost, which has been adopted as the standard primary trainer by the R.A.F., is fast becoming one of the most widely travelled trainers in the world. For some years past, Hunting Aircraft have energetically spread the jet trainer gospel in export-sales tours in the Americas and the East, and they have very recently completed two additional tours, to South America and India and Pakistan. In two instances during these later tours groups of pupils were chosen at random and given training up to solo standard with most satisfactory results. Serviceability of both airframe and Armstrong Siddeley Viper engine proved remarkably good, and the machines were both assembled and dismantled abroad without specialized equipment. Ferrying flights were made over some of the roughest country there is, and the only spares backing for the South American tour was carried, as noted later in this account, in two suitcases.

During the tours the Jet Provost was often flown from stony, rough fields, drenched runways, from airfields up to 10,000ft a.s.l. and in very hot weather. In no case was difficulty experienced and performance came up to estimates previously made. The principal navigation aid carried on both continents was a Marconi radio compass—the full-sized AD.7092 in South America and the lightweight AD.722 in the East. The latter installation was made hurriedly in about 36 hours, but gave excellent service.

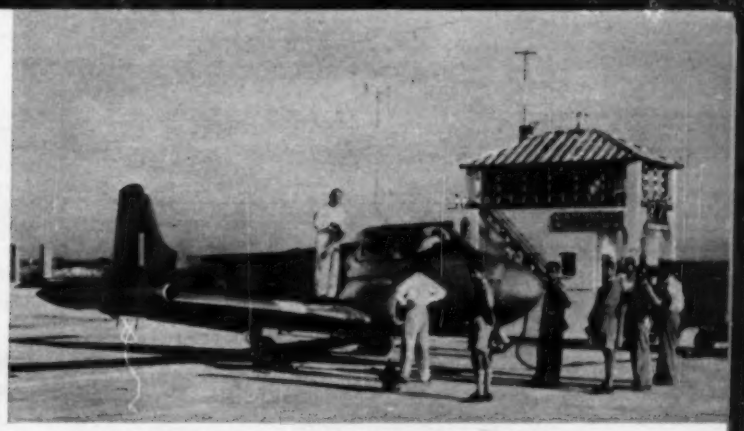
The visit to the East lasted some ten weeks and began at Aden in August, when S. B. Oliver, the chief test pilot, took over from the R.A.F. Jet Provost XN 117, a Mk 2 development machine which had been used by the R.A.F. for trials. R. J. W. Brown,

F/L. Jatar (right) and F.Cdt. Iqbal Singh, Indian Air Force, at Jodhpur. F/L. Jatar trained his pupil to solo standard in the Jet Provost in 9½ hr

Hunting technical sales manager, and D. Oxford of A.S.M. followed the aircraft by civil airliner. Jet Provost XN 117 had standard production wings, tip-tanks and full-view windscreen but was fitted with an ASV.9 engine instead of the usual ASV.8. From Aden Oliver flew the aircraft by stages—averaging about 300 n.m. at 220-230 kt and 20,000 to 25,000ft—to Karachi and thence to seven different bases in India and Pakistan, giving air-experience flights and aerobatic demonstrations, but mainly allowing the air forces of the two countries to see and evaluate the machine in their own environments. A P.A.F. mission had already inspected the type in Britain last year, when they also went to see the Fouga Magister and the little Italian Caproni F.5.

The flight from Aden to Karachi was made, incidentally, along the coast of the Aden Protectorate, along much of which the native population is hostile to Europeans. The landing points were at Riyad, Salalah, Masirah Island and Jiwani, north of the Persian Gulf. Salalah was the most difficult airfield, because weather is unreliable and generally poor at that time of year and the approach procedure calls for the use of an N.D.B. close to mountains. Only visual landings are possible and fuel is normally carried to allow a return to point of departure or overflying to the next airfield. The approach charts give detailed and forbidding instructions concerning the limitations. The Masirah - Jiwani leg of 310 n.m. is mostly over water, but is covered by a very powerful N.D.B. at Jiwani.

At Delhi, Peshawar and other places Oliver gave demonstrations for leading Government and air force personalities, and at Mauripur the Viper ASV.9 was exchanged for a standard ASV.8. The principal evaluations were made at Mauripur and Risalpur by the P.A.F. and at Jodhpur by the Indian Air Force. The



Jet Provost XN 117, on the way back to Karachi, is received outside the old control tower at Risalpur in Pakistan

latter chose to run a small sample course of basic instruction up to solo standard with two cadets chosen at random and two Indian instructors, S/L. A. Almeida, C.O. of the basic school at Jodhpur, and F/L. Jatar. The two cadets had each completed about 30 launches in gliders, but had no powered experience. The instructors were given an intensive indoctrination and two flights and then started instructional flying straight away. One of the pupils reached solo standard in 9½ hours, but the other failed to do so. In many cases Hunting have arranged these trial courses, always with cadets chosen at random, and a small proportion of them inevitably failed to make the grade, just as they would have done in any other type of trainer. Mr. Brown taught an Indian team to maintain the Jet Provost in a week. Normal training equipment at Jodhpur consists of Hindustan HT-2s and North American T-6A Texans.

The P.A.F. approached the evaluation rather differently, concentrating mainly on flying instructors in order to assess their opinion of the Jet Provost. A dozen T-33 instructors flew a total of about ten hours at Mauripur, and A. Cdre. Rabb, Chief of Staff to the C-in-C. of the P.A.F., flew the machine; he was, say Hunting, delighted with it.

All P.A.F. basic training is done in T-6Gs, the pilots then being posted to jet or piston units to convert to Freighters or Sabres. Such a one-type training programme raises some difficulties in re-equipment, but the T-6s are growing old and will have to be replaced. The ordering of new equipment must also depend upon the financial situation; and this takes no account of technical issues, especially if new aircraft might be supplied free under some aid programme.

A further dozen instructors, all with a preponderance of piston experience in T-6s and Furies, flew the Jet Provost at the basic training centre at Risalpur. They particularly liked the machine, above all for aerobatics, and found that it fitted comfortably with T-6s in the circuit. The Jet Provost speeds for both circuits and aerobatics are in fact only a few m.p.h. higher than those of the T-6. Average length of the flights was one hour, whether in the circuit or at height, although the tip-tanks were not filled. They were in fact only used for ferrying. During this programme, Oliver was assisted by S/L. Abassi, C.O., of the Jet Conversion Squadron, who shared the task of checking-out the instructors.

THE SOUTH AMERICAN TOUR

The following notes—a slightly abbreviated version of an account provided by Hunting Percival—give a day-to-day account of the South American tour.

Arrival. The Jet Provost was crated and shipped to Trinidad, where it was re-assembled by the company's service engineer, S. Ashby, who was later joined by F. A. Ashley of Armstrong Siddeley. Exceptionally hot weather, reaching 96 deg F, made conditions very trying for the party newly arrived from England.

The first test flight was carried out on April 21 by R. N. Rumbelow, test pilot of the company, who flew the aircraft throughout the tour. Flights at full load—just over 7,000 lb—were carried out in what turned out to be the highest temperatures encountered on the tour and these enabled the pilot to check take-off and climb performance (which closely approximated to the theoretical estimates) for future reference. [*Contd. overleaf*

Refuelling with Shell by hand pump and chamois filter at Quetta, 5,250ft a.s.l. Take-off was in 800 yd in a temperature of 33 deg C

JET PROVOST ODYSSEY. . .

Venezuela. On Monday, April 28, Rumbelow flew from Trinidad to Caracas, Venezuela, thus starting the tour proper. This flight of 340 n.m., was one of the longest of the tour and enabled an accurate check to be made of fuel consumption at the normal cross-country height of 25,000ft. Ashley accompanied Rumbelow, as he did in transit throughout most of the tour.

From April 28 until May 7, the aircraft remained in Venezuela, where flights were given to numerous Air Force officers at Maracay. The Venezuelan Air Force has British equipment in the form of Vampires, Venoms and Canberras. Training aircraft are, principally, Vampire T.11s and North American T-6s.

The Jet Provost was very well received and an excellent impression was given by an immaculate aerobatic demonstration by Rumbelow before an audience of senior officers which included the C-in-C. of the Venezuelan Air Force.

Colombia. The transit from Maracay to Bogota, Colombia, originally planned in four legs with one night stop was, in fact, accomplished on May 8 in three legs: Maracay - Maracaibo, Maracaibo - Barranquilla and Barranquilla - Bogota. Bogota is 8,500ft a.s.l. and is surrounded by even higher ground. Operation at this altitude was a new experience for the Jet Provost and a useful check on what might be expected later at Quito, which is some 2,000ft higher. Performance was well up to estimates at all loadings.

At Bogota flights were given to staff officers of the Colombian Air Force and another very impressive demonstration was given to a distinguished audience which included the British Ambassador.

Primary and basic training in the Colombian Air Force, using Beech T-34 Mentors and T-6s, is carried out at Cali and the Jet Provost was moved to that airfield for further demonstrations. From a discussion with the instructors who flew the Provost it was clear that the aircraft was very popular and the idea of jet *ab initio* training fully accepted.

Colombian Air Force training equipment consisting of T-34 (nosewheel), T-6 (tailwheel) and Lockheed T-33 (jet/nosewheel) is, of course, illogical and is recognized as such by them. It is of interest that their T-33s are Canadian-built (Canadair) and fitted with Nene engines.

Ecuador. On May 23 the aircraft left Cali for Quito (Ecuador) a high-altitude (10,000ft) airfield surrounded by the peaks of the Andes. Here airliners have to gain height in a spiral climb.

The Ecuadorean Air Force is equipped with Meteors and Canberras, which operate from Quito. Training is at Salinas, an airfield on the coast some 220 n.m. from Quito. Training at Salinas is done on Cornell PT-19s and North American T-6s. Because of the difficulty of providing fuel and starting facilities at Salinas instructors were brought up to Quito and all the Jet Provost flying was done there. A number of officers flew, including the commanding general, and all were enthusiastic, especially in regard to the Jet Provost's performance at this altitude.

Peru. The transit from Quito to Talara in Northern Peru involves crossing some of the wildest parts of the Andes range and the weather was far from favourable, involving an instrument climb through continuous cloud. Talara brought the Jet Provost back to sea level and to a new experience of desert country—conditions which it was to experience down the whole long haul to Santiago, Chile. The short hop to Chiclayo was followed by one of the longest legs of the tour, some 360 n.m. along the desert coast to Lima, which was reached in darkness and low cloud. By now, the pilot's trust in the Viper engine and in the Marconi radio compass was firmly established.

In Lima the Peruvian Air Force proposed an extensive evaluation—consisting of the training of five cadets to solo standard—of the Jet Provost in its rôle as an *ab initio* trainer, and it was agreed to undertake this somewhat formidable task.

The Peruvian Air Force training school (Stearmans and T-6s) is at Lima, where the weather from April to September is almost continuously overcast and the surrounding country unfavourable. It was, therefore, decided to move up north to Chiclayo, where the weather is as nearly perfect for flying training as could be wished. Details of the training experiment, which was outstandingly successful, are given at the end of these notes.

Deliveries of Jet Provost T.3s to the R.A.F. are now well under way and the views above and on the opposite page show the first true production machine. Ceylon is also shortly to receive the first armed Jet Provost, the prototype weapon installation for which is illustrated below. The two demonstration tours recorded in these pages were made with development aircraft similar to those shown here.

"Flight" photograph

After a return to Lima on June 22, with A. N. Kingwill as passenger, flights were given to a large number of staff officers and flying instructors.

The Canberras and Hunters of the Peruvian Air Force have thoroughly established their popularity and give high hopes for the further supply of British equipment.

Chile. On Saturday, June 28, the aircraft left Lima for Santiago, Chile, making refuelling stops at Pisco and Arequipa (both in Peru), Arica, Antofagasta and Vallenar. Bad weather and difficult airfield conditions were met with.

An aerobatic demonstration was staged at the El Bosque training airfield and flights given to two pilots; the remaining flights were given at Los Cerrillos, Santiago Airport, because of fuelling and starter problems at El Bosque. On July 2, ten Chilean Air Force officers were given flights—a record day during the tour. The C.A.F. use T-34s and T-6s for training and continue on T-33s and Vampire trainers. There was the usual enthusiasm for the Jet Provost.

Argentina. On July 3, Rumbelow flew to Mendoza, Argentina, over the highest part of the Andes, where the peaks reach to 25,000ft. At Mendoza flights were given to some Argentine Air Force officers, with an aerobatic demonstration for the special benefit of visiting officers of high rank.

Next day the aircraft moved to Cordoba, where are situated the Aeronautical Institute and the main training school. Flights were given to test pilots and technicians of the Institute and the commander and instructors of the school. At Cordoba the aircraft was operating from a very rough and dusty grass airfield. Flying was delayed a few hours to replace a damaged flap-interconnecting rod.

A move was made to Buenos Aires on July 8, and on the 13th, the Jet Provost flew to the Argentine Navy's F.T.S. at Bahia Blanca. This was a short but very successful visit and Rumbelow's aerobatic display was witnessed by a large and obviously pleased audience. A number of naval pilots also flew the aircraft.

The Argentine Air Force still retains a number of Prentices and Fiat G.46s, but now uses only the T-34 and G.46 for training. In the past there have been no jet trainers, pilots passing directly on to the Meteors.

Uruguay. The aircraft returned to Buenos Aires and on the 19th flew to Montevideo, Uruguay, with D. M. Bay as passenger.

Once again the aerobatics were witnessed by a large assembly, including the C-in-C. and the British Ambassador. Because of the excellent facilities at Carrasco Airfield, which is jointly used by civil aircraft and the Uruguayan Air Force all flying was done from there. Instructors from the training school and numerous staff and other officers flew, including the commanding general.

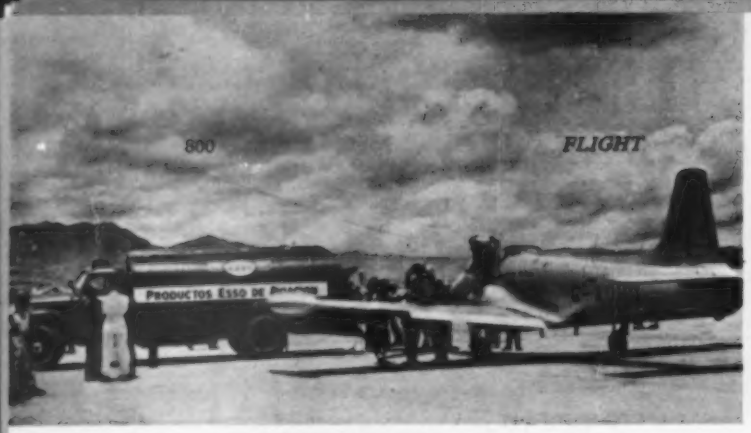
Primary training is done on Cornell PT-19s and Chipmunks followed by basic training on the T-6, and there are a few T-33s for jet conversion and advanced jet training.

Brazil. On July 25, the aircraft was flown from Montevideo to Rio de Janeiro in one day, making refuelling stops at Pelotas, Porto Allegre, Curitiba and Sao Paulo. The Sao Paulo to Rio leg was flown entirely in darkness, the take-off being made in local very low cloud a few minutes before the airfield was closed on account of bad visibility.

At Rio a comprehensive series of flights were given to many staff officers, including the Air Minister—whose offices are only a few minutes' walk from Santos Dumont airfield.

A visit was made to Santa Cruz airfield, outside the city, where the Meteor 7 and 8 trainers are stationed. The Hunting Aircraft party were most impressed by the Brazilian Air Force's standard of Meteor flying—particularly their formation flying.

A few days were spent at the training school at Campos dos



(Left) Refuelling amid typical South American scenery. (Right) Further typical scenery—Monte Aconcagua in the Andes, photographed from the Jet Provost while cruising at 20,000ft

The Peruvian Air Force cadets who reached solo standard in the Jet Provost, seen at the training base at Chiclayo. The youngest of them was 16 years old. Standing behind them are (l. to r.) S. Ashby, Hunting service engineer; Bill Kingwill, Hunting Services liaison officer; Maj. Alvistur, chief instructor; Sen. Luis P. Navarro; "Dick" Rumbelow, Hunting test pilot; Col. T. Gonzales, director of the flying training school; Capt. Hernandez; and F. A. Ashley, Armstrong Siddeley representative. Maj. Alvistur supervised the training experiment

JET PROVOST ODYSSEY . . .

Afonsos, a few minutes' flight from Santos Dumont. This is a beautifully appointed training centre, run on highly efficient lines, but the surrounding country is bad and the city has spread to the airfield boundaries, so that for modern aircraft the days at the school are numbered and new quarters will have to be found for it elsewhere. Training is on the PT-19 and the Fokker S-11, followed by the T-6. Jet training is on T-33s and Meteor 7s.

On August 2, by special permission of the authorities, Rumbelow gave his final aerobatic display off the famous Copacabana Beach. Apart from a party of special guests this display was seen by many thousands of Brazilians.

Further flights were given to Brazilian Air Force pilots at Santos Dumont and flying was finally completed on Tuesday, August 12, when work was at once started on dismantling the Jet Provost for crating and shipment back to Luton.

The Tour in General. Apart from demonstrating the skill of Rumbelow as a pilot, navigator and flying instructor, and of Ashby and Ashley as service engineers, the tour bore witness to the exceptional reliability of the Jet Provost and its Viper engine. Six to seven thousand miles from its home base, with only two suitcases of spares, the aircraft carried on consistently day in and day out. One instrument was replaced, two navigation light filaments, a pair of rubber seals in the brakes, one flap-interconnecting rod, and two mainwheel tyres. Fifty- and 100-hour schedules were carried out, in each case on a Sunday with no interruption to the flying programme. A welding repair was effected on the jet tail-cone at Montevideo, again without delaying the programme.

During the tour a total of 123 people flew in the aircraft. In some 8,400 miles' transit flying nine countries were visited and 27 airfields used. Total flying time was 178 hours in 268 flights. No fewer than 630 landings were made; this is explained partly by the *ab initio* experiment in Peru and partly by the fact that demonstration of the circuit and landing characteristics was deemed important everywhere.

The expedition was directed by D. M. Bay, deputy sales manager, who was accompanied by A. N. Kingwill, Services liaison officer.

THE PERUVIAN EVALUATION

As related earlier, a proposal by the Peruvian Air Force that five cadets should be trained to solo standard in the Jet Provost was made on arrival at Lima. It was proposed to train two cadets who had completed 40-50 hours' primary training on Stearmans, and three who had never flown. None spoke English. Fortunately Rumbelow is a qualified flying instructor who had been instructing on Jet Provosts during his R.A.F. service; furthermore, the side-by-side seating arrangement enormously lessened the difficulty of the language barrier. The Peruvian Air Force offered the help of a flying instructor to assist Rumbelow. The chosen officer was Capt. Hernandez, an experienced Hunter pilot who spoke good English. He had, however, no experience of giving *ab initio* instruction and it was necessary for Rumbelow to prepare a detailed instructional schedule from memory and to give Hernandez an intensive period of Jet Provost familiarization—five hours' dual and solo in all. Fortunately, a Spanish-language version of Pilots Notes was available, from which intensive "ground instruction" was given to the five cadets over a period of four days.

Rumbelow decided that in view of the language difficulty and because of Capt. Hernandez's very good showing in the Jet Provost he himself would undertake the training of the two part-trained cadets and allocate the training of the three complete novices to the Peruvian officer. The cadets were extremely youthful, the youngest being 16 years: in the event, he proved the most apt pupil.

Tuition was exceptionally concentrated. The statistics—one aeroplane, two instructors, five pupils, 55 hours, two weeks, speak for themselves; they almost certainly constitute some kind of record!

While continuity of training is advantageous up to a point, it seems probable that this degree of concentrated effort (unbroken by the diversion which ground training normally provides), tended to put the pupils under abnormal strain. Furthermore, they well knew that the eyes of the whole Peruvian Air Force were on them. This became apparent during the later circuits-and-landings stage and, coupled with the anticipation of a solo test, it appears to have slowed down progress, which up to then had been fast.

The times to reach solo standard were:—

With previous experience.—Cadet (2nd year) Arenas, 8 hr; Cadet (2nd year) de la Melena, 5 hr 40 min.

Without previous experience.—Aspirante Melgar, 9 hr 5 min; Aspirante Bucala, 13 hr 45 min; Aspirante Busse, 13 hr 45 min.

The whole experiment was extremely successful and instructive. It showed that in spite of the difficulties involved and the youth of the students (who were selected entirely at random) it was possible to reach solo standard within two hours of the Royal Air Force average.

The Jet Provost's route round South America

MAN-POWERED FLIGHT

"Promising Outlook" Described for Aviation by Muscle-power

PRESENTING the fourth Henson and Stringfellow Memorial Lecture to the Yeovil branch of the Royal Aeronautical Society on November 13, Mr. B. S. Shenstone, M.A.Sc., F.R.Ae.S., chief engineer of British European Airways, discussed the problems and possibilities of flight by muscle-power. Entitled *Man-powered Flight*, his paper has provided the following extracts.

"So many irresponsible people have played with the idea of man-powered flight that it is becoming difficult to take the matter seriously, even when it is discussed by technically qualified people. The main objection seems to be that since it has not yet been done, it never can be done.

"The assumptions here are twofold. On one hand is the thought that, if man could fly, he would have done so long ago. After all, we are so very clever in these brilliant technical times that if a little problem like this sort of flying were soluble we would have solved it. It is, of course, obvious that this attitude is nonsense. It would be better to say that if something hasn't been done it is high time to do it. On the other hand, there is no money in it, so why bother? Some people make money out of anything, but I assume there are far easier ways of making money than out of man-powered flight, and I hope we steer clear of it and concentrate simply on achieving the heretofore impossible. This brings me to the other assumption. Bees and birds fly, and bees fly more easily than birds, and big birds find it most difficult to fly. There is no known case of a creature weighing more than 32 lb that can fly. The bigger creatures grow, the less their specific strength . . .

"Man-powered flight is often thought to be far from reality, but in fact it has already been nearly done, and when something has practically been done, it usually takes only a moderate addition of ingenuity and knowledge to make it properly done.

"It is not generally known that in 1936 in Germany a single-seat man-powered aircraft made at least four flights over 200 yd in length at an altitude between 3 and 15ft and that these flights were officially observed. Each of the flights lasted about 20 sec. Indeed there was one flight which achieved a distance of 440 yd. These flights were made on an aircraft designed to try to win a prize offered in 1933 for the first man-powered flight in a closed circuit without intermediate landing around pylons 500 m apart. The prize has never been won, but at least it was close to being won. In Italy at about the same time the Bossi-Bonomi Pedialante was built with great care and skill, but not successfully flown.

"These are the facts and we can now approach the problem from several points of view. We can discuss the 32 lb bird and argue about the man's strength. We can find out why the German aircraft of 1936 could not fly more than 400 yd. We can deal with the problem from scratch and merely use the 1936 flights as encouragement. Probably it is better to use all methods of approach so that we can see whether there is now, over twenty years later, a good case to be made for the possibility of such flying.

"To argue from the birds does not lead us anywhere. We are not attaching wings to man and pushing him off a branch. The birds that work hard at flying are either fast or inefficient aerodynamically for very practical reasons . . .

The Optimum Power

"The German Haessler-Villinger aircraft failed mainly because the power transmission was not efficient, it being transmitted from bicycle-type pedals through a belt to a propeller shaft on which was a small propeller well below the optimum size (under 5ft). It also failed because knowledge of aerodynamics at that time was not sufficiently advanced. It also failed because the optimum power was not available. In other words, the optimum number of crew is not one, but is considerably more than one. I think it is common experience that a two-seater aircraft does not weigh twice as much as a single-seater, nor does it have twice the drag. However, a two-seater man-powered aircraft has rather more than twice the power available, because as a single-seater it is probably impracticable to use more than leg power of a man for locomotion, as he will need his hands to guide and control the aircraft. In the case of a crew of two the second man can exert all his energy, arms and legs for driving the aircraft . . .

"Using arms and legs a man has an instantaneous power of something of the order of 1.5 h.p. but for a minute's duration he can only exert about 0.8 h.p. However, for longer periods up to the time of the order of one hour he can exert 0.5 h.p. We can therefore use these powers with reasonable assurance but with full realization that if calculations are wrong or the usual things occur, such as the actual aircraft having more drag and weight than the design, the only way to get over it is to find a stronger man, and there isn't much scope in that . . .

"It is essential to do a cut-and-try design study varying the assumptions and then seeing whether the result fits the desired curve. Such a design study is full of important unknowns, such as structural weight, wing profile drag, fuselage drag, propeller efficiency, efficiency of mechanical drives and weight of driving mechanism. Information on actual weights of single-seaters in the past indicates that an empty weight for a single-seater can be as small as about 80 lb . . .

"The design difficulty on structural weight is essentially one of experience. To my mind it is quite clear that such a machine should be made of wood and fabric. The trouble is that there is hardly anybody left with experience of very light wooden structures. It is easy enough to design the spar but that is not where the weight goes. The weight disappears into the ribs and frames, secondary structures and fittings, and very careful calculations would have to be made, including reproduction of complete test sections, to ensure not only that the strength was of the right order, but that the weight was acceptable.

"The wing-section problem was until recently extremely difficult, but there is now some information available at the requisite Reynolds Numbers which are of the order 0.7×10^6. It is clear that what one wants to have is a wing section which has as much laminar flow as possible at this Reynolds Number and have the bottom of the laminar-flow bucket at a lift coefficient of the order of 0.9. No normal aeroplane wing section will give this characteristic, but fortunately at least two sections give some promise on this: NACA 65A(10)12 and the German Section FX05-H-126.

"The wing-section thickness which is practical on such an aircraft may be difficult to determine. Informal discussion with the Air Registration Board indicates that an ultimate load factor of not more than 2.5 will be acceptable with very little gust loading. This would mean that the wing would be very flexible and the detail design would have to be directed toward permitting it to be as flexible as possible, thereby saving weight and still avoiding flutter on control reversal at operating speeds.

Propeller Problems

"Perhaps the most difficult problem is that of the propeller and the drive for it. It is probable that the most efficient sort of drive is an adaptation of bicycle practice, that is, pedals, sprockets and chains. It is complicated by two factors: (1) the propeller tends to be distant from the crew position, and (2) the propeller shaft will be found to be at right-angles to the initial drive shaft. This would involve the use of bevel gears which tend to be heavy, or a twistable chain which has yet to be developed.

"There is also the detail design for minimum weight for shafting absorbing less than 2 h.p. with rotational speeds of about 120 r.p.m. on the initial drive shaft and up to 500 r.p.m. at the propeller shaft. The difficulty here will be designing the shaft small enough and light enough. As for the propeller, which would probably have to be 6ft or more in diameter, normal propeller construction would be too heavy. Possibly a propeller made entirely of balsa wood would be sufficient . . .

"Ground clearance of the propeller is important and one way of achieving this is Mr. Nonweiler's design, which involves making a very high fuselage and fin combined. One solution I put forward myself a couple of years ago involved a propeller half-way along the fuselage, which is a tricky mechanical problem although good aerodynamically. It is essential to get the slipstream free of the wing and that is certainly not easy to do. It is also desirable to have a light compact drive. The Haessler-Villinger achieved the compact drive by a simple twisted belt, but the propeller was not well located. The Bossi-Bonomi had normal tractor propellers in the wing leading edge and a long chain and shafting. Dr. D. R. Wilkie of University College, London, has suggested a very compact two-seater mechanism which involves both crew working the same crank.

"There are other possible solutions, and I will indicate to you some solutions suggested by Alexander Lippisch who spent many years in thinking about this problem. He considered the tail-first machine as a possibility but rather prefers the tail-less type of machine with sweep-back. There is much to be said for both layouts. However, Lippisch has made an attempt to reduce the length and weight of the driving mechanism and that is something which requires very careful consideration, for if the driving mechanism is a critical part of the design it may be necessary to compromise on what aspects you get the best overall result. . .

"The use of the flapping wing seems to be suggested mainly because if man wants to fly like a bird he wants to fly like a bird and not like something else. Adopting the flapping wing is adopting an extremely complex mechanism which suffers severely from structural scale effect and whose aerodynamics are not fully understood. The use of a flapping wing is the hard way towards

MAN-POWERED FLIGHT . . .

the solution of man-powered flight. Flapping should not be the first method to be tried in an attempt to achieve man-powered flight, because then you are attempting to solve two distinct problems at one time. First, you are trying to make the flapping work which has not yet been done on this sort of scale and, secondly, you are trying to accomplish man-powered flight which has also not been accomplished. . . However, there is considerable backing for the flapping wing and Walter Filter of Germany has built one and in U.K. Emiel Hartman is building one. Another approach is that the wing be designed to use the Katzmayr effect . . .

"My main point is that the best way to attack the problem of the man-power is to do it in the simplest possible way, using available knowledge to the greatest possible extent and thereby experiment to the minimum degree. This attitude I feel has the best chance for initial success, although it may not produce the most efficient man-powered aircraft. However, the point is that it does seem that there is enough information to indicate that with present knowledge man-powered flight is possible. . ."

After discussing take-off problems, Mr. Shenstone continued:

"At present, there is no likelihood of the man-powered aircraft rising more than a few feet above the ground because the power required within the ground cushion is so much less than the power required about 15 to 20 ft. In fact, at about 10 ft altitude the ground effect doubles the effective aspect ratio of the wing which has a large effect on the power required, because the wing incidence is quite high. Hence the possibility of man-powered flight in the initial stages would be over flat fields, such as an airfield, or over a moderate-sized piece of water. . ."

The lecturer went on to describe the activities of the Man-powered Aircraft Committee, and then concluded:

"The outlook for flight by man-power is certainly promising and, compared with the development of even a light aeroplane, the development of a man-powered aeroplane will probably be quite cheap.

"The main difficulty lies in the small tolerances allowed. If the aircraft is not correct from a structure point of view, from the weight point of view, from the aerodynamic point of view and the mechanical point of view, it will not fly. It is worth reiterating that it is unlike any other form of aircraft in this respect, there being no reserve of power to call upon, and therefore no way of correcting mistakes, except by re-designing and re-building.

"A failure on the first serious attempt to build and fly such an aircraft would leave widespread doubts in the minds of people as to its ultimate practicability, and therefore if success is to be achieved, the problem must be approached in a sound technical manner and taken as seriously as the design of any powered aircraft."

Space Research

OBJECTIVES, METHODS AND PROGRESS REVIEWED AT ROYAL SOCIETY MEETING

THE scientific aspects of space research formed the wide subject of a two-day meeting held by the Royal Society in London on November 12-13. Organized by Prof. H. S. W. Massey and held under the chairmanship of Sir Cyril Hinshelwood, President of the Society, the meeting attracted a large audience of scientists from this country and abroad, although an invitation extended to Soviet scientists to attend had not been accepted.

What scientific information could we get from the tools now available? This, said Prof. Massey in his introduction, was the main theme of the meeting. After outlining the programme, he emphasized that space research was a field demanding international collaboration on a really large scale.

The first four papers presented at the meeting dealt with physical properties to be determined in the Earth's atmosphere, in interplanetary space and on the surface of the nearer planets. The broad structure of the fringe of the atmosphere, in particular its composition and temperature, was defined in the form of a static model by Prof. D. R. Bates in *Scientific Problems concerning the Earth's Atmosphere above 100 km.* This was followed by *Interplanetary Space and Solar-Terrestrial Relations* by Prof. S. Chapman.

Among the points arising from these papers and their general discussion were the facts that the concept of the exosphere as being isothermal at about 1,500 deg was now doubted; that there was a marked geographical effect—measurements from Fort Churchill and the higher-latitude satellites differed markedly from those obtained from White Sands and the lower-latitude satellites; and that, in any case, the nature of the interplanetary gas remained speculative at the present time.

Speaking on *Cosmic Rays*, Prof. C. F. Powell referred to two aspects of the study of these rays which had received particular attention. Cosmic radiation provided a source of particles of very much higher energy than could be generated in man-made machines for some time to come, and so would continue to be the means of investigation into the physics of elementary high-energy particles; and the second aspect was the determination of the nature of the primary particles entering the high atmosphere. Once the recovery problem had been solved, Prof. Powell suggested, much valuable information could be obtained from an artificial satellite in a 200-300 mile orbit near the geomagnetic equator. This would be more effective and might prove cheaper than measurements from aircraft and balloons.

At the beginning of his paper *The Moon and Nearer Planets*, Prof. T. Gold emphasized that many new discoveries would be made, and we could predict neither what would be found nor which particular studies would prove to be the significant ones. In the inner part of the solar system, which included Mars, Venus and the Moon, the first thing to be discovered was the "weather"—i.e. temperatures, magnetic fields, and non-thermal particle fluxes.

A study of the nature of the surface of the Moon could provide information on the evolution of the Earth. This study could be made by a satellite which circumnavigated the Moon, televising back to Earth detail pictures of selected areas. Circumnavigation could also provide data on the lunar atmosphere, which the speaker thought was transient rather than permanent, and on the Moon's magnetic field, if any. Other possibilities were of "hard landings" and "soft landings" on the surface of the Moon, providing more-detailed local pictures; and the use of tractor-type vehicles which would explore awhile before sending back information.

As for Mars, the first question was whether there was any form of life—more likely here than on any other planet. Again circumnavigation, hard landings and soft landings would each provide specific information. A hard landing could enable measurements of the atmospheric density and perhaps temperature to be made, but the problems of transmitting a televised picture were considerable.

Venus, whose surface was permanently covered by a dense layer of cloud, would also be investigated by similar techniques. Temperatures on Venus appeared high for life (or, at least, a terrestrial type of life) to be possible, but a primary interest would be simply to discover the nature of the planet's surface, e.g. whether liquid or solid. Even the Sun could be investigated by launching a vehicle directly towards it: this vehicle could certainly pass through a substantial part of the corona. The important general principle in the exploration of space was that the scientists, their aims and their instrumentation should not fall behind the engineers and their progress in rocketry.

The second day of the meeting opened with a discussion on *Astronomical Observations from outside the Atmosphere.* The first speaker was Mr. F. Hoyle, who began by listing three major factors which made optical observations from the ground inadequate. These were (1) wavelength restriction, (2) spreading of the telescopic image, even with large equipment, and (3) the amount of background light in the night sky. Theories could no longer be checked by observations from the ground; it was necessary to get out of the atmosphere to carry out full investigations.

While it would not be too difficult to mount a 20in telescope

ROYAL SOCIETY DISCUSSION MEETING ON SPACE RESEARCH

Main Speakers

Prof. H. S. W. Massey, F.R.S., Professor of Physics, University College, London; chairman of the United Kingdom I.G.Y. Artificial Satellite Sub-Committee; chairman of the Gassiot Rocket Sub-Committee of the Royal Society.
Prof. D. R. Bates, F.R.S., Professor of Applied Mathematics, Queen's University, Belfast.
Prof. S. Chapman, F.R.S., president, Special Committee for the I.G.Y.
Prof. C. F. Powell, F.R.S., Professor of Physics, Bristol University.
Prof. T. Gold, Harvard University, U.S.A.
Mr. F. Hoyle, F.R.S., Department of Mathematics, Cambridge University.
Dr. J. G. Davies, Jodrell Bank Experimental Station, Manchester University.
Dr. A. W. Lines, Department of Guided Weapons, R.A.E. Farnborough.
Mr. W. T. Blackband, Department of Radio, R.A.E. Farnborough.
Dr. R. L. F. Boyd, Department of Physics, University College, London.
Prof. J. Sayers, Department of Electron Physics, Birmingham University.
Dr. H. E. Newell Jr., U.S. National Aeronautics and Space Administration.
Mr. D. G. King-Hele, Department of Guided Weapons, R.A.E. Farnborough.
Prof. J. van Allen, State University of Iowa, U.S.A. (paper presented by Prof. Chapman).

in a satellite, the problem of extending the observable frequency range was a very difficult one. This needed to be done, however: the use of strong lines in the ultra-violet region of the spectrum would simplify the surveying of clouds of gas in and between the galaxies, and if the long-wave (infra-red) region were included the process of formation of stars could be studied. The speaker agreed that it was often the unexpected things which were important, quoting three important astronomical events which, but for various flukes, might still be unknown.

Deputizing for Prof. A. C. B. Lovell, Dr. J. G. Davies completed the picture by describing aspects of radio-astronomy. As with optical astronomy, he said, there were three similar basic restrictions to observations from the Earth. The effects of the ionosphere and of absorption limited the frequency band at long-wave and short-wave ends of the spectrum respectively, and there were similar spreading and background radiation problems. Concerning the extension of the wave-length limits, there were interesting radiations at both ends of the scale, although at the short-wave end observations might be more difficult.

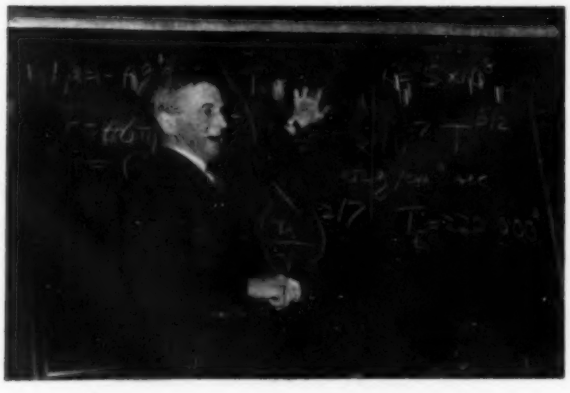
Propulsion, Guidance and Control, Tracking and Data Recovery was the next general heading, and the first three of these factors were discussed by Dr. A. W. Lines. With a first-stage thrust of 200,000 lb, he showed, a satellite weighing more than a ton could be placed in a near orbit—as had already occurred in the case of Sputnik 3. Such a satellite could be stabilized in a known orientation offering additional facilities for scientific measurement and, if desired, the orbit could be fairly precisely defined prior to launch. The power requirements for stabilization, scientific equipment and telemetry might pose a severe problem in providing sufficient sensitive area for solar batteries, if long-period operation was envisaged. The design of complex equipment to operate for, say, a year without attention would also be difficult.

Satellites to travel out to distances of a few Earth radii could have a weight of many hundreds of pounds. For more eccentric orbits the weight would be less and it might not be feasible to provide stabilization unless the equipment weight could be reduced. Careful planning of these projects was therefore essential, starting with the selection of the major types of experimental measurements to be made. From these the need for stabilization and the type of orbit would be determined, and compromises between the conflicting requirements of experiment and complexity of control and guidance would certainly be necessary. At a later stage, Dr. Lines concluded, if low-thrust, very-high specific-impulse motors could be developed, it would be feasible to adjust satellite orbits and investigate particular regions of space around the Earth in a more controlled manner.

Tracking and data recovery were dealt with by Mr. W. T. Blackband, who spoke mainly of lunar probes rather than satellites. The main problem was to detect a weak radio signal against background noise from the receiver, from transmission lines and aerial, and from galactic noises from the active regions (as opposed to the quiet regions) of the sky. The use of the Doppler principle to control the frequency of radio transmission should give a tracking accuracy of about one kilometre per hour of travel, or ± 60 km on a 60 hr lunar journey, compared with ± 4,000 km by interferometer.

Individual Examples of Techniques of Physical Measurement were described and shown by Dr. R. L. F. Boyd and Prof. J. Sayers. Dr. Boyd described the use of vehicular motion to assist measurements; the use of Langmuir probes; and the use of simplified "pick-a-back" experiments. Prof. Sayers concentrated on Skylark experiments instrumented by the Birmingham University group, which were designed (1) to measure ion density and (2) to provide mass analysis of the ionisation in the area through which the rocket was moving.

Prof. Sydney Chapman delivering his lecture on interplanetary space



Dr. Homer Newell Jr. (left) of the new U.S. organization N.A.S.A., with Prof. H. S. W. Massey, chairman of the British I.G.Y. Artificial Satellite Sub-committee and organizer of the Royal Society meeting

Many speakers at the meeting had referred to the "van Allen layer" of corpuscular radiation as the most significant discovery yet brought to light by artificial Earth satellites, and it was unfortunate that Prof. van Allen was not able to be present on this occasion to describe this phenomenon. In his absence a report on his findings was read by Prof. S. Chapman as the first contribution to the session devoted to *Results obtained from Satellites already Launched*.

The main purpose of the U.S. satellite 1958 Epsilon (Explorer 4), launched on July 26, 1958, had been to study the radiation belt revealed by results from earlier satellites. Improved detection apparatus had been devised, and the angle of orbit was increased to 51 deg. The useful life of the satellite was eight weeks, during which time the orbital period decreased from 110 to 108.7 min, the apogee decreased from 2,210 to 2,070 km, and the perigee varied between 257 and 267 km.

Information from Explorer 4 had been recorded on magnetic tape, and some 25 per cent of the data had been surveyed to date. A preliminary analysis of this data, in which ground receiving stations had been grouped into sectors according to longitude, and contours of constant counting rate had been drawn, gave a basic picture of the shape of the belt. It had been concluded that the radiation was corpuscular, was charged—probably it comprised ionised solar gas—and that it was trapped in this belt at a height roughly equal to the radius of the Earth, and data from the Pioneer moon-probe had seemed to agree with this.

Great increases in the measured intensity of the belt had been closely related to auroras and magnetic storms. Although the range and energy spectrum could not yet be specified, nor had the particles been conclusively identified, it was believed that this radiation was the cause of auroras and that the dominant contribution to it was from solar gas.

Other less-spectacular results from rockets and satellites were detailed by Dr. H. E. Newell, Jr., who quoted figures for density at heights from 228 km to 355 km but said that the situation concerning the measurement of micrometeorites was unexpectedly confused. Mr. D. G. King-Hele referred to R.A.E. work on the observation of the second and third sputniks, which had indicated irregularities in air density (a stepped rise), a gradual decline in the orbital inclination, and pertubations to the orbit caused by the Earth's magnetic field.

A second paper by Dr. Newell entitled *The United States Artificial Satellite Programme* gave a comprehensive account of the ambitious National Aeronautics and Space Act, 1958, approved by the U.S. Senate on July 29 this year. This had resulted in the formation of the National Aeronautics and Space Administration, whose research programme included the following studies:—

(1) Atmospheres, including dynamical aspects of the Earth's upper atmosphere and location of its outer fringe; the atmospheres of Venus, Mars, Jupiter, Moon (does it have an atmosphere?) and Sun (how far does the Sun's atmosphere extend, and is Earth within it?); (2) ionospheres, including the relation of the Earth's ionosphere to the van Allen belt, and the ionospheres, if any, of other planets; (3) high-energy particles; (4) electric and magnetic fields; (5) photons; (6) astronomy; and (7) controlled experiments under conditions (vacuum, weightlessness, high-energy particles) unobtainable on Earth.

The N.A.S.A. programme, Dr. Newell emphasized, would be only a proportion of the total U.S. national programme but the new Administration did provide a new national centre. The Services, government departments, universities, colleges and other organizations, including the Space Science Board of the National Academy of Science, would continue with their own projects.

Summing-up the two-day meeting, Prof. Massey said that the whole economics of satellite research depended on instrument reliability. Several of the papers presented had shown that, provided effective instruments could be designed and built, there were many advantages in sounding rockets, satellites and probes.

On the two days (November 14-15) following this meeting, the new international committee on space research (COSPAR) held its first meeting in the rooms of the Royal Society. This committee was set up by the International Council of Scientific Unions during its eighth General Assembly in Washington last month. Great Britain was represented by Prof. H. S. W. Massey.

Club and Gliding News

LAST week-end the Fakenham Flying Group held a very successful rally at their airfield at Little Snoring, a few miles north-east of Fakenham, Norfolk. Despite misty weather 24 aircraft were present, including a smart Rollason/Normande Jodel D.117, Joan Short's white Rollason Turbulent from Cambridge, a Slingsby T.21 and its Chipmunk tug from the R.A.F. Gliding and Soaring Association, a Fison Airwork Hiller, two American-registered Cubs from the U.S.A.F. Mildenhall Aero Club, the Bishop Tiger, various other Tigers, Austers and other types, and *Flight*'s Gemini. F/L. Ken O'Rourke and Sue Burges were prevented by dusk and fog from making parachute jumps on the Saturday afternoon, but O'Rourke jumped next day. Visitors were warmly welcomed in the bright new club-house.

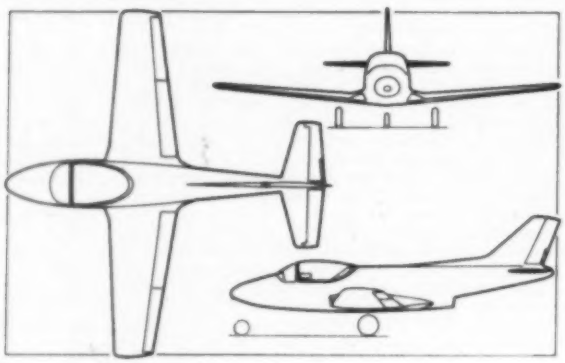
The high proportion of participants among the spectators made the afternoon friendly and, after the Fakenham group had opened proceedings with some skilful tied formation flying in three Tigers and some zestful individual aerobatics, everyone got airborne and the fun continued till the last usable light was smothered by gathering fog. They flew both low and high for an audience which was never more than a few yards from the scene of operations. A race was cancelled because of poor visibility, but bombing of two targets with flour-bags was often accurate and always exciting for those in the target area. The glider, finding its landing baulked by two other aircraft, made an expert overshoot on little more than will-power.

The Bishop was expertly presented by both C. Nepean Bishop and Colin Labouchere and a runaway "pupil" was clearly heard screaming for help as he dived past the spectators on his way to a kangaroo landing. The Hiller was most effectively demonstrated with its spray gear. By the light of car headlamps and torches the aircraft were then stowed in the hangar and the participants repaired to the Officers' Club at Sculthorpe for an excellent dinner, dance and floor show. Next morning further demonstrations and a general exchange of joy-rides passed the time until fog lifted in the south and visitors could return home. Altogether this was a most friendly and instructive occasion. It is only to be lamented that, of five British light-aircraft manufacturers invited to attend, only Rollasons arrived. The Garland-Bianchi Linnet was prevented by unserviceability and the remaining firms cried off, refused or did not answer the invitation. This seems particularly sad, for the Fakenham group includes several potential customers.

"WE in the Royal Aero Club view with alarm and despondency the decision of the Government to close Croydon Aerodrome. As a staunch supporter of the Government in Parliament, I say in all sincerity that, if implemented, this will be a national disaster." This comment was included in a Press statement made by Col. C. F. H. Gough, M.P., chairman of the Royal Aero Club, at Londonderry House last week. He continued:—

"Croydon is a birthplace of British flying. Next to London Airport it is the busiest airport in the country. It has all the attributes essential for the development of private flying. It is within easy reach of London; it has excellent public transport facilities, it has adequate airport buildings and hangars, customs facilities, a grass landing area and an adjoining hotel and restaurant. Perhaps most important of all, it can and should be developed as a British National Aviation Centre, at which all aeronautical interests other than commercial air services could be represented and encouraged. Nothing to my mind could give a greater fillip than this to the expansion of private flying.

"No other proposal yet put forward has all these criteria, nor do they give any sort of security of tenure that can possibly be acceptable. We are extremely grateful to the Minister and the Parliamentary Secretary for the interest that they have taken in our affairs—I particularly welcome the new Joint Standing Committee set up under the chairmanship of Mr. Airey Neave. We ask them, therefore, as friends of ours to have another think on this vitally important subject, before taking a step which may well stand them condemned before the bar of history as a disastrous blow to British Aviation."



Claimed to be the cheapest four-seat aircraft on the U.S. market, the new Piper Caribbean costs $8,395 and is derived from the PA-22 Tri-Pacer. Powered by a 150 h.p. Lycoming O-320 engine, it cruises at 132 m.p.h. at 75 per cent power at 7,000ft. First deliveries are to be made in mid-December

AT the recent annual general meeting of the Lancashire Aero Club the following club committee was elected: D. L. Armitage (chairman), F. Fairclough, B. Hamblett, A. T. Hodge, R. B. Stockfis, Dr. Sidebotham, J. Simpson, N. Bradpiece, P. Jefferies, L. Roy, R. Ogden and A. C. Lacey. For "meritorious service and devotion to duty during the past year" the Parnell Trophy was awarded to the club's assistant chief flying instructor, Charles Rollo.

TRIAL lessons for the 15 applicants for the 1959 W.J.A.C. flying scholarships are being held at several flying clubs and will be completed in time for awards to be made before the end of the year. The winner or winners should then be able to begin flying training early in the spring of 1959. In Scotland, a similar flying scholarship fund has been set up by the Scottish Girls' Training Corps for members of the organization's Junior Air Corps group.

BUSINESS aircraft in the U.S.A. flew over one million hours more than domestic scheduled airlines in the year 1957. This information was among the initial results of a survey of general aviation made by the Civil Aeronautics Administration. During 1957 the C.A.A. reported that scheduled domestic airlines logged 3.6 million hours and 785 million miles. By comparison, aircraft engaged in general aviation (business, commercial, instructional, pleasure and miscellaneous flying) flew 10.9 million hours and travelled 1,400 million miles. Since 1950 business flying has formed the largest segment of general aviation. The 1957 figure for this group was 4.9 million hours compared with 2 million hours ten years ago. Pleasure flying logged the second largest flying time total (2.1 million hours) in the general-aviation sphere.

Other recent C.A.A. statistics indicate that men pilots outnumber women pilots in the ratio of 40 : 1, with a total number of civil licensed pilots of 809,349 the highest figure on record. The largest single group comprises 448,470 private pilots.

NEXT year's National Gliding Championships will be held at Lasham Gliding Centre from Sunday, May 10, to Monday, May 18 (Whit Monday). This is the third consecutive time the contest will have been held at Lasham. The main change in the arrangements compared with previous years is the alteration of dates from the last week in July to the week preceding Whitsun week-end.

LONDON GLIDING CLUB has decided to establish a Frank Foster memorial fund. At present the form which the memorial will take has not yet been decided. Those wishing to contribute to the fund should send donations to the London Gliding Club, Dunstable Down, Beds.

CONSTRUCTION of a prototype two-seat light jet aircraft intended for touring, sports and executive flying is now under way at the modern Milan factory of Progetti Construzioni Aeronautiche, a new Italian company headed by engineer Rico Neeff. Known as the Neeff F.400 Cobra, the new type has been designed by Stelio Frati, whose recent designs include the Falco and Nibbio, and is powered by a Turboméca Marboré 2. Range at 15,000ft should be at least 650 miles, and the maximum level-flight speed is quoted as 325 kt.

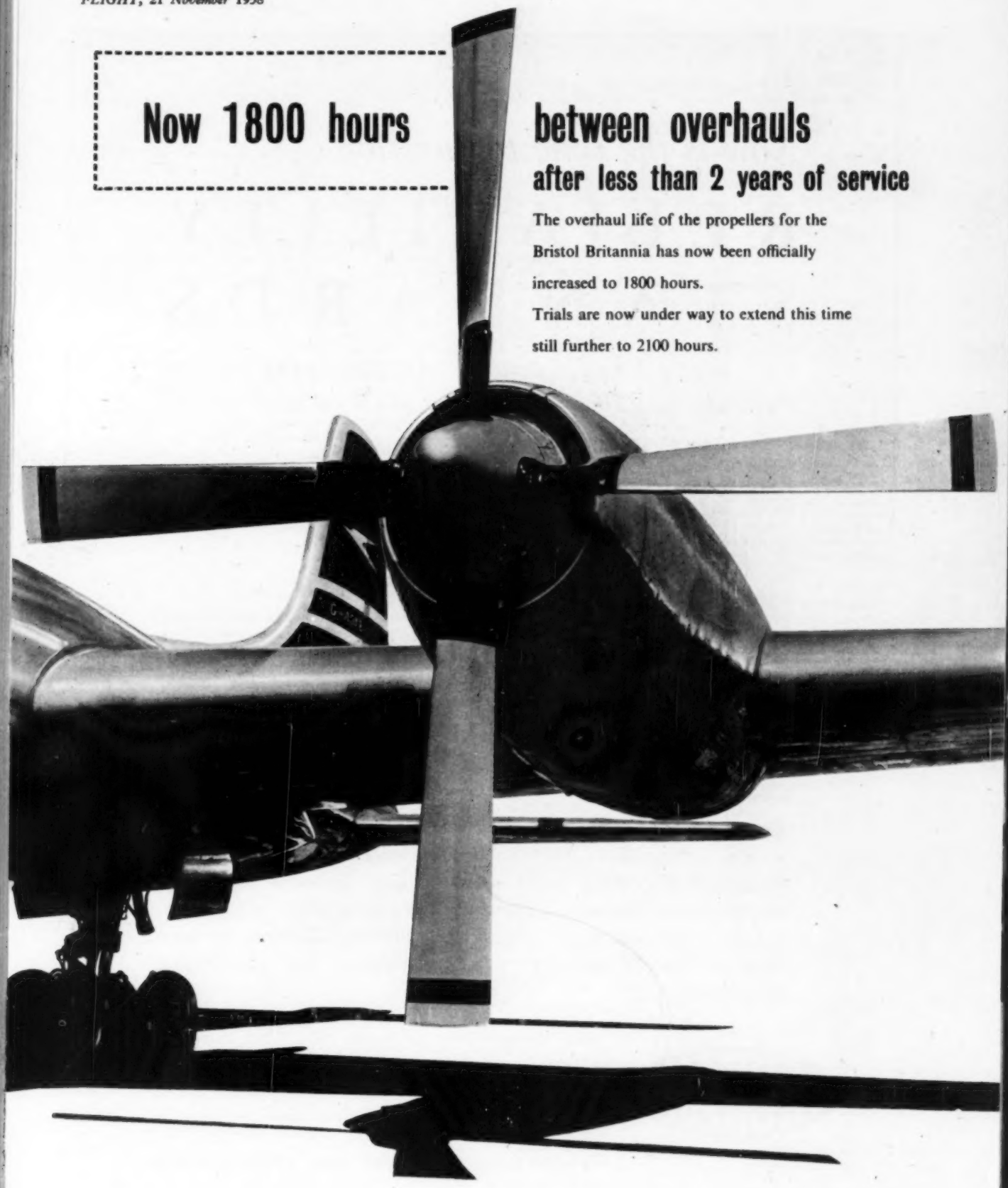
The Neeff F.400 Cobra, powered by a Turboméca Marboré 2, will have a span of 28ft 6in and a maximum speed of 325 kt

Now 1800 hours between overhauls

after less than 2 years of service

The overhaul life of the propellers for the Bristol Britannia has now been officially increased to 1800 hours.

Trials are now under way to extend this time still further to 2100 hours.



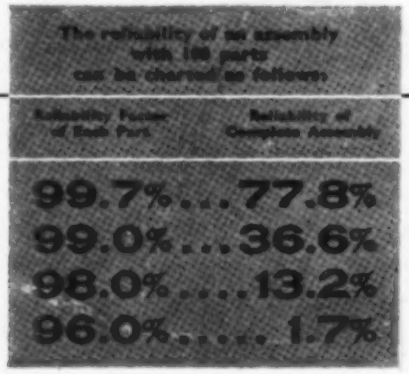
DE HAVILLAND PROPELLERS

HATFIELD HERTFORDSHIRE

Now is the time to question . . .

RELIABILITY STANDARDS

Too many have been set at the level of the poorest-quality producer in an industry!


The reliability of an assembly with 100 parts can be charted as follows:
Reliability Factor of Each Part
Reliability of Complete Assembly
99.7% . . . 77.8%
99.0% . . . 36.6%
98.0% 13.2%
96.0% 1.7%

An increase of only 1% in the reliability factor of each of 100 individual parts will nearly triple the over-all reliability of an assembled product

UNBRAKO companies have the highest economic reliability level in the following fields:

Aircraft precision screws, locknuts, plate nuts and channel nuts · Nuclear threaded components · High temperature engine, rocket, turbine and missile fasteners · Alloy socket screw products · Industrial cap screws, nuts and related fasteners · Commercial self-locking screws and all-metal locknuts · Advanced super-strength steel fasteners · Titanium products. **Services:** thread metrology studies, research and metallurgical developments.

Contact Unbrako—write for booklet titled "High Reliability"

Unbrako · Coventry · England

UNBRAKO

Standard Pressed Steel Co. · The Cleveland Cap Screw Co. · Columbia Steel Equipment Co. National Machine Products Co. · Hutt-Shel Co. · SPS Western · Standco Canada Ltd.

Unbrako screws cost less than trouble

WORLD'S LARGEST PRODUCER OF PRECISION THREADED FASTENERS AND RELATED PRODUCTS

Straight and Level

FROM time to time something happens which prompts one to say: "That's the most sensible thing anyone has done for years."

Such an event is the decision by S.A.S. and Swissair to rationalize their DC-8, Convair 880 and Caravelle equipment programmes. All these aircraft will be standardized and interchangeable, and there will be mutual engineering and leasing arrangements.

Likewise Pan American and National have been given official blessing to go ahead with a similar kind of get-together involving Boeing 707s and DC-8s.

Here are four airlines which, while apparently surrendering none of their sovereignty, are cutting down costs in a big way. They deserve loud applause because they are pioneering a healthy economic trend which, in the long-term view, can only expand the market for air transport.

● I know I am fighting a losing battle, but I still refuse to be deterred from defending my mother-tongue against the onslaught of Americanisms.

"Rugged," for instance. Once or twice, in its usual wrong application, it has even slipped into *Flight*, evading the fine-toothed plastic comb which our sub-editor uses instead of a blue pencil. And now, from the pen of a technical writer who ought to know better, I learn that a certain high-performance aeroplane has a "rugged wing."

My *Shorter Oxford English Dictionary* says that, depending on the context, "rugged" may mean rough, hairy, shaggy, uneven, full of stones, wrinkled, furrowed, harsh, unpolished, rude or uncultured.

Perhaps, of course, the wing is wool-tufted for stall-testing, and we all know that quite good aeroplanes sometimes suffer from wrinkled skins. But I wonder if the designer of this one has heard of G.E.C.'s heavy alloy? So much better than stones.

That the *O.E.D.* adds "U.S.: Strong, robust, vigorous, 1848," leaves my withers (whatever they may be) unwrung.

● I still hear influential people say: "Scrap the I.A.T.A. cartel. Let air transport find its own economic level." They forget that when I.A.T.A. fails to reach agreement, governments intervene. Consider the recent actions of the Italian Government.

Last September the Italians banned PanAm 707s from Rome, because, they said, jets might lower the traffic safety level. But I wonder whether another reason—perhaps the *real* reason—was to protect Alitalia's traffic.

Shortly afterwards, at the I.A.T.A. meeting at Cannes, Alitalia demanded a jet surcharge. I.A.T.A. disagreed, so the Italian government stepped in. PanAm were asked what fares would be charged for 707 services. "Normal fares," said PanAm. I do not know what the Italians replied, but the next day PanAm cancelled plans for 707 services to Rome.

There were hurried diplomatic exchanges. Suddenly the Italians relented—and PanAm flew their 707s into Rome. Why did the Italians suddenly back down? I have no doubt that they value Alitalia's U.S. traffic rights, *and* the airline's DC-8 order—things which are vulnerable to political sanctions.

Scrap I.A.T.A. and thus would air commerce be run by politicians, with consequences which I leave to your imagination.

Stewardesses must be prepared for everything, especially on economy-class services. Those long, long flights with only a simple sandwich to eat may attract the customers all right—but will they fly with you again? That little extra personal attention by pretty cabin staff may make all the difference

● Although many British engineers are anything but well informed about it, Pratt and Whitney's little JT-12 turbojet is likely to give us quite a run for our money. Not the least remarkable thing about it is the speed with which it has been developed. Studies began in July 1957, detail design started in September 1957, drawings were released in January 1958, first bench run was in May 1958, and a 50-hr endurance test was successfully run in August 1958.

In this country we have shown how well relatively small firms can tackle big jobs—for example, Blackburn's NA.39 and Handley Page's Victor. But there might be more evidence of the Pratt and Whitney approach—namely, big firms dashing off small bread-and-butter projects.

● In the good old days when every R.A.F. aeroplane had a propeller it used to be thought that jet personnel would perpetually be getting sucked into intakes or blown away by murderous jets of hot gas. A subtle change is apparent.

Recently a colleague was about to leave an R.A.F. Bomber Command (Vulcan) base in *Flight's* Gemini. The Station Commander earnestly entreated him to take care that none of the ground staff walked into one of the Gipsy-driven propellers—"They're just not used to them."

● This is what American Airline pilots think about some of their employers. I quote Mr. C. N. Sayen, president of the American Airline Pilots Assn.:—

"Some airlines have accepted their responsibility and planned carefully for a gradual transition to the jet age. Others have blundered into the jet age without adequate preparation, have created chaotic situations with which they cannot live, and are now trying to get someone to bail them out of their financial, technical and industrial relations difficulties . . ."

● Who says nobody's doing anything about the problem of airport-to-city transport? Take Thomas Fitzpatrick, a fitter of New Jersey, for instance. Which is exactly what the New York police did after he had landed somebody else's Cessna in Amsterdam Avenue, a main thoroughfare in Manhattan. Not that this was a new idea—Mr. Fitzpatrick first accomplished the feat two years ago. Summing up his reasons for the benefit of the police, as they charged him with grand larceny and three violations of municipal regulations, Mr. Fitzpatrick disclosed: "It's the lousy drink."

● "In our striving to find the ultimate weapon of tomorrow," Mr. Donald Douglas remarks, "we should not neglect the weapons of today, for this is when we need them."

● I liked the dialogue reported at London Airport just before Dr. Barnes Wallis left for America to discuss his variable-geometry designs.

Ministry of Supply spokesman: "The object of this visit is a pooling of knowledge to explore further the possibility of a joint research effort to determine the practicability of making use of this principle to meet a possible future NATO requirement and should be viewed in the general context of interdependence."

Dr. Barnes Wallis: "I don't understand a word of it. But they won't let me say anything more . . ."

ROGER BACON

North America	Latin America	Europe	Elsewhere

BOEING

B.367: No. built 10, in airline service 9.
B.377: No. built 57(exc. 888 KC-97), in airline service 49.
B.707: No. built 6, in airline service 6.

North America		Latin America		Europe		Elsewhere	
N'west (377)	9	COHATA (307)	1	BOAC (377)	12	Air Laos (307)	2
PanAm (377)	24					Aigle Azur (307)	6
PanAm (707)	6						
T'Ocean (377)	4						

CANADAIR

DC-4M: No. built 46 (exc. 71 milit.), in airline service 41.

North America		Latin America		Europe		Elsewhere	
TCA	21			BOAC	16	EAAC	4

CONVAIR

CV-240: No. built 165 (exc. about 550 milit. 240/340), in airline service 152.

North America		Latin America		Europe		Elsewhere	
American	59	A. Argentinas	5	Alitalia	4	Air Jordan	2
Mid-Continent	1	Cruzeiro	10	DFG	5	Iranair	2
Mohawk	11	Varig	10	Finnair	1	Transarab	1
Northeast	7			LOT	3		—
PanAm	1					Ethiopian	3
Western	6						—
						CAT	1
						Garuda	8
						Pakistan	5
	—						—
CPAL	5					TAA	2
	90		25		13		24

CV-340: No. built 212 (exc. about 550 milit. 240/340), in airline service 199.

North America		Latin America		Europe		Elsewhere	
Braniff	26	A'naves de Mexico	4	Alitalia	4	Saudi-Arab	10
Continental	7	Avensa	5	Finnair	3		—
Delta	23	Cruzeiro	4	JAT	3	Garuda	8
Hawaiian	8	LACSA	2	KLM	13	PAL	2
National	12	Real	6	Lufthansa	4		—
United	53					Ansett-ANA	2
	129		21		27		22

CV-440: No. built about 140, in airline service 138.

North America		Latin America		Europe		Elsewhere	
Braniff	5	Avensa	1	Alitalia	2	All Nippon	3
Continental	3	Cruzeiro	4	Condor	2	Garuda	3
Delta	5	Real	18	Finnair	3		—
Eastern	20			Iberia	5	Ansett-ANA	5
National	6			Lufthansa	5		
				JAT	2		
				Kar-air	2		
				Sabena	12		
				SAS	20		
				Swissair	12		
	39		23		65		11

CATALINA: No. built 2,140, in airline service 49.

North America		Latin America		Europe		Elsewhere	
Alaska Coast	1	AIDA	1	Flugfelag	1	CAT	2
Arctic-Pac.	1	Bahamas	1			Foshing	1
	—	PAB	5			Macau	1
Austin	1	Transa-Chile	2			RAI	1
CPAL	2	TAM (Peru)	4			UBA	1
N. Wings	2	TAP (Brazil)	2				—
Nordair	3					Qantas	2
Pac. West	4						
Transair	4						
Wheeler	2						
World Wide	3						
Others	2						
	25		15		1		8

CURTISS

C-46: No. built 3,141, in airline service 362.

North America		Latin America		Europe		Elsewhere	
Aaxico	40	Aerunion	2	Aeropa	2	El Al	6
Air Cargo Exp.*	1	ALA (Chile)	4	Olsen	3	Leb. Internat.	1
Arctic-Pac*	2	Austral	3	Transair (Sweden)	3	Air Jordan	1
ASA	6	Avensa	3				—
Alaska	2	Aviateca	1			Air Maroc	1
All American*	4	California	2			Air Cameroun	2
Argonaut*	1	CBF	3				—
Associated	2	Cubana	1			Aigle Azur	1
Cal. Haw.*	2	Cuba Postal	3			CAT	22
Capitol*	18	CDA	5			Foshing	1
Braniff	2	CINTA	1			TAC	1
Conner*	3	COPA	2				
Cont. Charter*	3	Ecuatoriana	2				
Cordova	1	Expresso Inter-americanos	3				
Currey*	2	LACSA	4				
Delta	5	LANICA	2				
Federated*	2	LAV	4				
Flying Tiger	6	LEBCA	3				
Great Lakes*	1	Loide	23				
Los Angeles*	1	NAB	2				
Meteor*	6	Nacionales	2				
Regina*	1	Peruanas	2				
Riddle	14	Q	4				
Seaboard	2	RANSA	19				
Skyways*	2	Real	16				
Southern*	2	SAM	4				
Trans. Carib.	2	SAP	2				
Westair*	6	TACA Internat.	1				
Wien	5	TAN	6				
	—	Transa-Chile	3				
CPAL	6	T'Continental	3				
Mar. Central	3	Varig	14				
Nordair	2						
Pac. West	2						
Quebecair	1						
Wheeler	2						
World Wide	5						
Others	1						
	166		152		8		36

FLIGHT COPYRIGHT

Airliner Census

WINTER 1958-59

Notes and comments on pages 808 and 814

North America	Latin America	Europe	Elsewhere

de HAVILLAND (CANADA)

BEAVER, DHC.2: No. built 1,207, in airline service 145.

North America		Latin America		Europe		Elsewhere	
TAG* (Illini.)	2	Avianca	11			CAAC	5
Wien	4	CDA	1				—
	—	Rojas	2			Aigle Azur	2
Austin	5	TAM (Peru)	4			Air Laos	1
Laurentian	6	Taxader	7			Cambodge	1
Mar. Central	1					de Kroonduif	1
N. Wings	4					Malayan	6
Pac. West	21					Pioneer	1
Sask. Govt.	4						—
Transair	3					Qantas	4
Wheeler	1						
Others	48						
	99		25				21

OTTER, DHC.3: No. built about 300, in airline service 38.

North America		Latin America		Europe		Elsewhere	
TAG* (Illini.)	2	Taxader	1	Wideroes	4	Air Laos	2
	—					Aigle Azur	4
CPAL	2					All Nippon	1
Pac. West	2					PAL	4
Sask. Govt.	1						—
Wheeler	5					Qantas	2
Others	8						
	20		1		4		13

DOUGLAS

DC-3, C-47: No. built 10,928, in airline service 1,617.

North America		Latin America		Europe		Elsewhere	
Alaska	2	ALA	4	Aer Lingus	10	Aden	8
Allegheny	15	A. Argentinas	16	Air France	39	Air Jordan	3
Amer. Flyers*	4	A'naves de Mex.	13	Alitalia	8	Air Liban	3
Blatz*	1	Aeronorte	4	Braathens	1	Arab	3
Bonanza	10	AREA	2	CSA	21	Arkia	4
Braniff	23	AMSA (Mex.)	5	Finnair	10	Iranair	6
Cal. Haw.*	2	Aviateca	7	Flugfelag	3	Kuwait	2
Cal. Central	1	Avianca	31	Iberia	16	MEA	4
Capital	18	Brit. Guiana	4	JAT	13	S'Arab	10
Caribbair	5	BWIA	4	Kar-Air	3	Syria	3
Central	10	CDA	2	KLM	11	THY	16
Continental	13	CINTA	2	Linjeflyg	9		—
Cordova	2	COHATA	1	Lufthansa	3	Aerotechnique	6
Delta	15	Consolidades	16	Olympic	14	Africair	3
Frontier	25	COPA	2	Sabena	24	Air Algerie	3
General*	3	Cruzeiro	34	Swissair	8	Air Maroc	3
Gt. Lakes*	1	Cubana	6	Transair (Swed.)	2	Air Madagascar	2
Hawaiian	8	Faucett	8	TAI	1	CAAC	5
Johnson*	2	LAB	7	TAP	4	DETA	3
Lake Central	10	LAC			—	DTA	6
Mackey	2	LACSA	4	Airwork	3	EAAC	9
Manx*	1	LADE		BEA	46	Ethiopian	7
Mohawk	9	LAN (Chile)	18	BKS	4	Ghana	1
N. Central	26	LANICA	7	Cambrian	2	Liberian	2
Northeast	11	LAV	16	Dan-Air	2	SAA	6
N. Consol	4	Mexicana	19	Derby	3	Sudan	7
N'West	5	NAB	15	Don Everall	1	Tunis	3
Ozark	20	PLUNA	6	Hunting-Clan	5	WAAC	7
Pac. North	4	RAC	3	Scottish	1		—
Pac. (S'West)	10	Real	84	Silver City	8	Air Ceylon	2
Panagra	4	Reforma	10	Skyways	4	Air India	1
PanAm	2	Sadia	2	Starways	3	Air Laos	6
Piedmont	21	SAETA	5	Transair	11	Air Outre-Mer	1
Quaker City*	3	SAHSA	6			Air Vietnam	7
Reeve	3	SAM	2			Aigle Azur	6
Sourdough*	2	SAVAG	6			All Nippon	8
Southeast*	5	Skyways	1			Ariana	4
Southern	13	Taca de Hon.	10			Cathay Pac.	1
Standard*	2	Taca de Venez	13			CAT	5
Stewart*	2	TAC (Brazil)	1			Cambodge	1
Trans. Internat.*	4	TAI (Mex.)	2			COSARA	4
Trans. Pac.	8	TAM (Peru)	8			de Kroonduif	3
Trans. Texas	18	TAMSA	2			Foshing	2
TWA	5	TAS	1			Garuda	10
West Coast	14	Taxader	3			IAC	62
Western	2	T.M. de Cortes	3			Kalinga	15
Wien	3	Unides	3			Korea Nat.	3
	—	Varig	23			Malaya	11
Austin	2	VASP	15			North Japan	1
CPAL	7					PAL	29
Mar. Central	7					PIA	10
N. Wings	2					Thai	5
Nordair	3					UBA	8
Quebecair	6						—
Pac. West	6					Ansett-ANA	16
Rimouski	5					Butler	3
Sask. Govt.	2					East-West	4
Transair	3					Guinea	5
TCA	8					MMA	5
Wheeler	4					Mandated	5
World Wide	3					N.Z. Nat.	24
Others	8					Qantas	8
						Queensland	3
						TAA	18
	437		456		293		431

DOUGLAS, cont.

DC-4, C-54: No. built 1,163, in airline service 351.

North America		Latin America		Europe		Elsewhere	
Alaska	2	A. Argentinas	6	Aerotour	4	Air Jordan	1
American	2	A'naves de Mex.	3	Air France	24	Air Liban	2
Capital	12	ALA (Chile)	2	Am. Internat.	2	Iranair	1
Central*	2	APA	1	Braathens	2	Leb. Internat.	2
Eastern	1	ATSA	1	Flugfelag	2	Saudi Arab.	4
Flying Tiger	6	Avianca	12	Iberia	6	Syrian	2
General*	1	Aviateca	1	Loftleidir	2		—
Gt. Lakes*	1	CDA	2	LTU	2	Air Algerie	6
Mackey*	3	CINTA	3	KLM	15	Air Maroc	4
Meteor	2	COPA	1	Olympic	1	SAA	7
N'West	11	ENA	2	Sabena	9	Trekair	2
Overseas Nat.*	2	Faucett	4	Sobelair	2	Tunisair	2
Pac. North	2	Guest	1	Swissair	3		—
Panagra	2	LAB	2	TAI	2	Air Vietnam	1
PanAm	25	LADE		TAP	3	Ariana	2
PSA	1	LANICA	1	Transavia	2	CAT	2
Regina*	1	Loide	4	UAT	1	Cathay Pac.	1
Resort*	3	Mexicana	6		—	IAC	6
Riddle	4	Q	1	Air Charter	3	JAL	9
Seaboard	1	RAC	3	Independent	2	Korea Nat.	1
Slick	6	Real	3	Starways	1	TAIP	1
T'Carib.*	3	TACA Internat.	2			Thai	3
TWA	2	TAP (Brazil)	2				—
United	2					Ansett-ANA	2
U.S. O'Seas*	8					Qantas	5
Westair*	2					TAA	4
Western	3						
World*	4						
World Wide	2						
	—						
Mar. Central	3						
Pac. West	2						
Transair	1						
Wheeler	4						
Others	4						
	130		63		88		70

DC-6: No. built 174 (exc. 167 milit. DC-6/6A), in airline service 163.

American	50	A. Argentinas	6	Alitalia	3	Cathay Pac.	1
Braniff	9	Mexicana	4	KLM	6		—
Conner	1			Sabena	4	Ansett-ANA	2
Continental	1			SAS	12	TEAL	3
Delta	7			TAI	1		
National	4						
PanAm	4						
Trans. Carib.*	3						
United	42						
	121		10		26		6

DC-6A: No. built 60 (exc. 167 milit. DC-6/6A), in airline service 37.

American	8			Condor	(1)		
Flying Tiger	2			KLM	2		
PanAm	3			Swissair	1		
Regina*	2				—		
Riddle	1			Eagle	2		
Slick	5			Hunting-Clan	2		
United	5						
	—						
CPAL	4						
	30				7 (1)		

DC-6B: No. built about 290, in airline service 283.

Alaska	3	Avensa	3	Alitalia	8	Air Liban	3
American	25	LAN	4	JAT	2	Ethiopian	3
Braniff	1	Loide	4	KLM	6		—
Eastern	5			Olympic	3	Cathay Pac.	1
Continental	4			Sabena	7	CAT	2
National	8			SAS	13	JAL	6
N'East	10			Swissair	6		—
N'West	20			TAI	4	Ansett-ANA	4
Panagra	4			UAT	9		
PanAm	41						
United	41						
U.S. Overseas	1						
Western	15						
	—						
CPAL	15						
Mar. Central	2						
	195		11		58		19

DC-7: No. in airline service 134.
DC-7B: No. in airline service 59.
DC-7C: No. in airline service 122.
} No. built about 350

American	58	Mexicana (C)	4	Alitalia (C)	6	SAA (B)	5
Braniff (C)	7	PAB (C)	4	KLM (C)	15		—
Continental (B)	5			Sabena (C)	10	JAL (C)	4
Delta	17			SAS (C)	14		
Delta (B)	4			Swissair (C)	5		
Eastern (B)	28			TAI (C)	3		
National	4			BOAC (C)	10		
National (B)	4						
N'West (C)	15						
Panagra (B)	6						
PanAm (B)	7						
PanAm (C)	25						
United	55						
	235		8		63		9

FAIRCHILD

C-82 PACKET: No. in airline service, 4.

		Guest	1				
		Mexicana	3				

GRUMMAN

VARIOUS FLYING BOATS (ALBATROSS, GOOSE, MALLARD, WIDGEON): No. in airline service 47.

North America		Latin America		Europe		Elsewhere	
Alaska Coast	9	Bahamas	2	Flugfelag	1	Guam	3
Avalon	7	Brit. Guiana	2				
Cordova	2	St. Vincent	1				
Ellis	9						
Mackey*	2						
Reeve	1						
	—						
BNP	3						
Laurentian	1						
Pac. West	2						
Others	2						
	38		5		1		3

LOCKHEED

L.10/12/14/18: No. in airline service 57.

Al. Coast	1	CINTA	2	Kar-Air	1	CAS (S. Africa)	3
Byerley*	1	LAN (Chile)	2	Linjeflyg	4	DETA	3
National	8	LAV	1	Wideroes	2	DTA	3
Pac. North	1	Norsur	3				—
Prov. Boston*	2	Santafesinas	3			Adastra	3
	—	Skyways	1			Associated	2
Matane	4					Carsair	1
Others	1					East-West	2
						MMA	1
						South-Coast	2
	18		12		7		20

L.049: No. built 88, in airline service 59.

Braniff	2	ALA (Chile)	1			El Al	5
Cal. Haw.	1	Cubana	1				
Capital	10	SAP	2				
Coastal Cargo	1						
Delta	4						
TWA	32						
	50		4				5

L.749: No. built 133, in airline service 130.

Alaska	2	A'naves de Mex.	3	Air France	16	Air Algerie	2
Eastern	18	Avianca	1	KLM	10	Air Maroc	1
Pac. North	4	Guest	2		—	SAA	4
Transocean	6	LAV	1	BOAC	10		
TWA	39	PAB	11				
	69		18		36		7

L.1049 (incl. C.D.E.): No. built 102 (exc. about 320 milit.), in airline service 78.

Eastern	28	LAV	1	Air France	9	Air India	5
Seaboard	10			Iberia	5	PIA	3
TWA	9			KLM	8		
	47		1		22		8

L.1049G: No. built 130, in airline service 125.

Eastern	10	Avianca	4	Air France	13	Air India	5
Northwest	4	Cubana	3	KLM	9	Thai	3
TWA	28	LAV	4	Lufthansa	9		—
	—	Varig	5	TAP	3	Qantas	14
TCA	11						
	53		16		34		22

L.1049H: No. built 41, in airline service 40.

Dollar*	1	T'Continental	3	KLM	2	PIA	2
Flying Tiger	14	Real	4				—
National	4					Qantas	2
Resort*	2						
TWA	4						
U.S. O'Seas*	2						
	27		7		2		4

L.1649A: No. built 43, in airline service 43.

TWA	29			Air France	10		
				Lufthansa	4		

MARTIN

M.202: No. built 43, in airline service 31.
M.404: No. built 103, in airline service 94.

Allegheny (202)	18	LAN (202)	4				
Eastern (404)	57	LAV (202)	2				
Pac. (S'West) (202)	7						
TWA (404)	37						
	119		6				

NOORDUYN

NORSEMAN: No. in airline service 119.

Alaska	5	Aviateca	1	Flugfelag	1	PAL	4
Wien	5	Orientales	1	Wideroes	6	Thai	3
	—					Carsair	1
Austin	7					Gibbes Sepik	6
Nordair	5						
N. Wings	3						
Pac. West	12						
Sask. Govt.	4						
Transair	16						
Wheeler	5						
Others	34						
	96		2		7		14

FLIGHT Airliner Census . . .

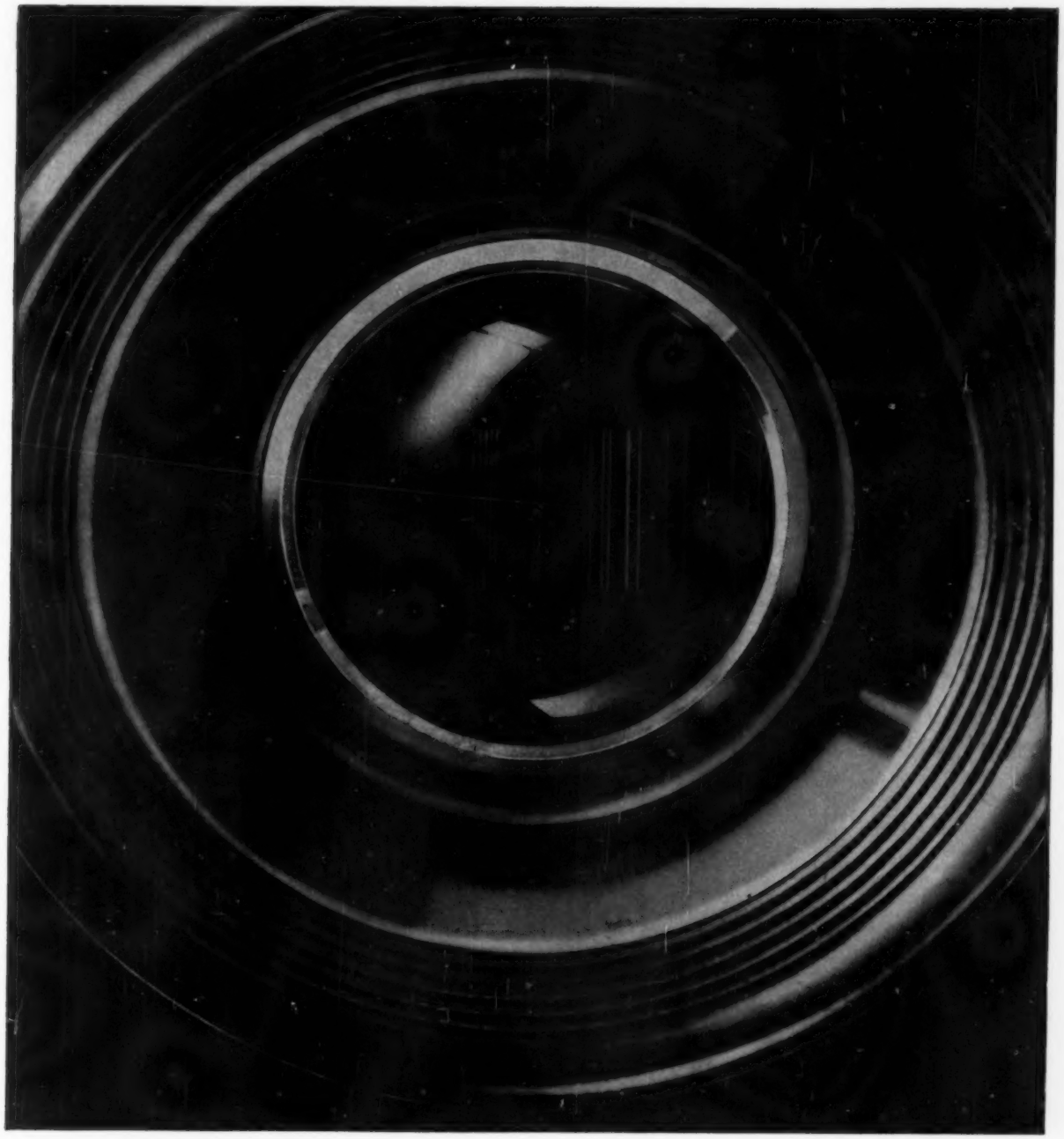
This second issue of *Flight's* Airliner Census is a reflection of an industry poised on the brink of the jet age. The limiting line in selecting the contents of the tables is whether a given aircraft type is already in airline operation. Comet 4 and Boeing 707 are thus included while the Electra and Friendship narrowly fail to qualify.

Regional disposition of North American airliners is shown on pages 806 and 807, and of British airliners on page 808. A break and short rule in each column denotes regional subdivisions: N. America into U.S. and Canada; Europe into the Continent and U.K.; elsewhere into the Mid-East, Africa, Asia and Australasia. The number shown against each operator refers to the aircraft used rather than owned, the figures in parentheses referring to aircraft ordered but not yet delivered. Where a blank space is shown against an airline the precise number is unknown. Asterisks indicate that the carrier concerned is not certificated.

N. and S. America	Europe	Mid-east and Africa	Asia and Australasia
AIRSPEED (now de HAVILLAND)			
AMBASSADOR: No. built 21, in airline service 2.			
	BKS 2		
AVRO			
ANSON: No. built 11,020, in airline service 41.			
Wien 5 Austin 2 Pac. West 7 Transair 1 Others 4 — AREA 5			Adastra 2 Carsair 2 Flinders 3 MMA 4 Papuan 3 South Coast 1 Woods 2
24			17
TUDOR: No. built 33, in airline service 6.			
	Air Charter 6		
YORK: No. built 256, in airline service 33.			
Pac. West 1	Danair 5 Hunting-Clan 3 Skyways 16	MEA 1 Trans-Med. 7	
1	24	8	
BRISTOL			
BRISTOL 170: No. built 214, in airline service 63.			
Wardair 1	Affretements 3 Aviaco 4 Iberia 4 LTU 1 — Air Charter 9 Channel 2 Danair 2 Eagle 1 Jersey 1 Silver City 21	MEA 1 Saudi Arab. 5 — Gyr. Nord. 1	Ansett-ANA 3 SAFE 4
1	48	7	7
BRITANNIA 100: No. built 15, in airline service 15 (B.O.A.C. only).			
BRITANNIA 300, 310: No. built 31, in airline service 31 (6).			
CPAL 6 A'naves de Mex. 2 Cubana (4)	BOAC (100) 15 BOAC (310) 18 Air Charter 1 Hunting-Clan (2)	El Al 4	BRISTOL Aircraft
8 (4)	34 (2)	4	
de HAVILLAND			
RAPIDE: No. built 697, in airline service 119.			
Rimouski 1 — SATGA 3 TAM (Peru) 6 Taxader 4	Falcks 1 Flugfelag 1 — Air Couriers 3 Airviews 2 BEA 3 Cambrian 1 Channel 2 Derby 1 Don Everall 3 Jersey 2 Morton 3 Silver City 3	Aden 2 Air Jordan 1 Arkia 1 Iranair 3 — Aerotechnique 1 Air Brousse 4 Air Ivoire 2 Africair 2 Air Algerie 3 Air Madagascar 4 Caspar 3 DETA 7 DTA 3 EAAC 4 Sierra Leone 3 STA (Angola) 3 S.W. Africa 1 TAGP 2 TGA (Gabon) 3 Zambezi 3	Borneo 3 Malayan 3 — Adastra 1 Conellan 2 Fiji 1 Mandated 3 N.Z. National 2 Transpac 3 Trans-Island 1 TAA 3 West Coast 3
14	25	55	25
DOVE: No. built 500, in airline service 55.			
Catalina* 1 Desert* 1 Gulf Coast 1 Southeast 1 TAG (Illini) 2 — Tampico 1	Cape Verde 2 Falcks 1 Martins 1 SATA (Azores) 2 — Airviews 1 Channel 4 Morton 7	Gulf 4 Iranair 1 Iraqi 1 DETA 4 Sudan 4 WAAC 2	All Nippon 4 TAT 2 UBA 3 — MMA 3 Southern 2
7	18	16	14
HERON: No. built 132, in airline service 73.			
TAG (Illini) 1 — Bahamas 3	Aviaco 5 Braathens 2 Falcks 1 UAT 7 Vestlandske 1 — BEA 2 Eagle 4 Jersey 7 Morton 1 Overseas 1 Silver City 1	Gulf 3 THY 7 — Ghana 2 TAGP 1 WAAC 8	All Nippon 3 IAC 7 TAIP (Goa) 1 Transpac 1 — Associated 1 N.Z. National 1 Southern 2
4	32	21	16
COMET 4: No. built 5, in airline service 5 (28)			
A. Argentinas (6)	BOAC 5 (14) BEA (6)	EAAC (2)	

N. and S. America	Europe	Mid-east and Africa	Asia and Australasia
HANDLEY PAGE			
MARATHON: No. built 11 (exc. 29 milit.), in airline service 6.			
	Derby 3 Martins 1		All Nippon 2
	4		2
HERMES: No. built 25, in airline service 17.			
	Airwork 4 Britavia 5 Skyways 8		
	17		
SCOTTISH AVIATION			
TWIN PIONEER: No. built 13, in airline service 12 (8).			
	Scottish 1 Fison-Airwork 2	Brit. Internat. 2 — Ghana (1)	Borneo 2 de Kroonduif 3 Malayan 2 (2) PAL (5)
	3	2 (1)	7 (7)
SHORTS			
SANDRINGHAM: No. built 33, in airline service 11.			
SEALAND: No. in airline service 1.			
SOLENT: No. built 23, in airline service 8.			
Mantz (Sol.) 3 — A. Argentin. (Sand.) 6 CAUSA (Sand.) 3	Vestlandske (Sea.) 1 Portugal (Sol.) 3	Shorts	Ansett (Sand.) 2 TEAL (Sol.) 2
12	4		4
VICKERS			
VIKING: No. built 160, in airline service 115.			
BWIA 1 LADE 15	Aerotour 2 Aerotransport 1 Aviameer 1 Balair 2 Continental 2 D. Flugdienst 5 Transavia 5 — Airwork 5 Eagle 20 Hunting-Clan 9 Independent 7 Orion 1 Overseas 3 Pegasus 1 Tradair 5	Brit. Inter. 2 Iraqi 3 Misrair 6 — Air Safari 3 CAAC 2	IAC 12 TAIP (Goa) 2
16	69	16	14
VISCOUNT 700 series: No. built 260, in airline service 252 (4).			
Capital 58 Northeast 9 TCA 47 (4) — BWIA 8 Cubana 3 LANICA 2 LAV 3 PLUNA 3 TACA Internat. 1	Aer Lingus 4 Air France 11 Alitalia 10 Austrian 4 Flugfelag 2 — Airwork 2 BEA 25 Hunting-Clan 3	Iraq 4 Iran 3 MEA 7 Misrair 4 THY 5 — CAAC 4	Hong Kong 2 IAC 10 PAL 2 UBA 3 — TAA 13
134 (4)	61	27	30
VISCOUNT 800, 810 series: No. built 100, in airline service 95 (22).			
Continental 15 — Cubana 4 VASP 5	Aer Lingus 3 (3) KLM 9 Lufthansa 3 (6) — Airwork (2) BEA 40 Eagle 2 Hunting-Clan (3) Transair 3	SAA 7	PIA 3 — Ansett (4) N.Z. Nat. 1 (2) TAA (2)
24	60 (14)	7	4 (8)

One advertisement in a series of nine.



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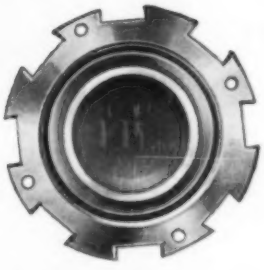

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SERVICE AVIATION

Royal Air Forces and Naval Flying News

Used personally by the A.O.C.-in-C. Bomber Command, Air Chief Marshal Sir Harry Broadhurst, this R.A.F. Hunting Pembroke bears his four-star rank insignia and has a six-seater passenger compartment

Air Chief Marshal McEvoy

PROMOTED from Air Marshal to Air Chief Marshal, Sir Theodore N. McEvoy has been Chief of Staff, AAFCE, since May 1956. Previously he was R.A.F. Instructor at the Imperial Defence College, and from 1950 to 1953 he held the post of A.C.A.S. (Training).

New Chaplain-in-Chief

NOW Assistant Chaplain - in - Chief, Bomber and Home Commands, the Rev. F. W. Cocks is to be Chaplain-in-Chief to the R.A.F. from next April in succession to the Venerable Archdeacon A. S. Giles who is retiring from the Service.

The Rev. F. W. Cocks was Assistant Chaplain - in - Chief, F.E.A.F., from October 1955 until taking up his present posts in June this year and one of his previous appointments was that of Senior Chaplain at A.H.Q. India in 1946. He won a Cambridge rugby blue in 1935 and has for some years been chairman of the R.A.F. Cricket Association.

Chaplain-in-Chief since May 1953, the Ven. A. S. Giles was taken prisoner by the Japanese in Java during the war, having been with Far East H.Q. at Singapore since 1937. After the war he was mentioned in despatches and appointed O.B.E. for distinguished services whilst in captivity.

Valiant "Scramble"

FIVE Valiants of No. 543 Sqn. were airborne within 6 min 2 sec of the alarm sounding in an impressive "scramble" staged at R.A.F. Wyton on November 10 for a party of NATO officials headed by M. Spaak, the Secretary-General. The aircraft were taxying on to the runway 3 min after the alarm sounded, and the first was airborne in 4 min 7 sec.

The visitors flew from Paris in a Comet of R.A.F. Transport Command and were welcomed by the Secretary of State for Air, Mr. George Ward. They were given a comprehensive briefing on the potential of Bomber Command as a deterrent force and the work of the Central Reconnaissance Establishment. In the hangars they saw the three types of V-bomber and also the Lightning, a demonstration of whose capabilities was subsequently given by S/L. James Dell.

F/S. F. G. Johns, who last Friday received the L. G. Groves Memorial Prize for 1958 and a monetary award from the Air Council for his "jet clock" safety device, showing his invention to Air Marshal Sir Geoffrey Tuttle, D.C.A.S., who presented the award, and Maj. Keith Groves (who presented the prize) and Mrs. Groves

Round-the-World Comet 2

ON the first round-the-world flight ever to be made by a Comet 2 the A.O.C-in-C. Transport Command, Air Marshal Sir Andrew McKee, left R.A.F. Lyneham on November 10 and is due to return there on December 2. His aircraft, from No. 216 Sqn., is flying westwards and the planned flight time is 81 hr. Its route includes Christmas Island, Fiji, New Zealand and Australia and on the return journey it will go into Hong Kong—the first time a Comet of R.A.F. Transport Command has ever landed there.

Senior Posts

AT present A.O.C. No. 12 Group, Fighter Command, A.V-M. H. P. Fraser is to be Director of R.A.F. Exercise Planning from January 1 next year. He will be succeeded as A.O.C. No. 12 Group by A. Cdre. J. R. A. Embling (with the acting rank of air vice-marshal); and the appointment has also been announced of A. Cdre. H. H. Chapman as Director-General of Technical Services, Air Ministry, from October 1, with the acting rank of air vice-marshal.

A.V-M. Fraser spent nearly two years as Chief of Staff, AAFCE, before going to No. 12 Group in June 1956. He has done a great deal of test flying, being awarded the A.F.C. before the war for services with the aerodynamic flight at the R.A.E. Farnborough; and one of his post-war appointments was the command of the A. and A.E.E., Boscombe Down. A. Cdre. Embling is at present taking the Imperial Defence College course, prior to which he was Eastern Sector Commander, Fighter Command. He won the D.S.O. in 1942 when C.O. of No. 77 Sqn. A.V-M. Chapman was S.A.S.O. at No. 90 (Signals) Group until his present appointment, and had previously (from 1952 to 1953) been Director of Signals (Policy) at Air Ministry.

U.A.S. Future

CONTROL of the university air squadrons is shortly to be transferred from Home Command (now officially abolished) to Flying Training Command. This news of administrative change was given by A.V-M. H. V. Satterly at the Aberdeen U.A.S. annual dinner on November 8. He added that the occasion was probably the last time he would have an opportunity of speaking to members as A.O.C. of the Group (No. 64) which controlled twelve of the university squadrons, and gave a valedictory warning about the U.A.S. future. An official review was due in about three years' time; he thought it would probably begin in two ("knowing how the Treasury works"), and that all those interested in the squadrons should start to pave the way for it now. "If you value your U.A.S. you should take every opportunity of saying so. We in the R.A.F. value these squadrons greatly, but our word only may not be enough."

A.V-M. Satterly referred to the fact that while in competition for the Scone Trophy (which Aberdeen last won in 1953) the squadron had been fourth last year and second this year, in the Hack Trophy contest it was "going the other way." But with extra care and extra luck there was no reason why it should not win both. Aberdeen was first alphabetically; perhaps next year it would be first in fact.

The squadron's commanding officer, S/L. K. Stevens, said that it was starting the new year with 38 members. There had been 70 applications for membership, and with an establishment of 40 there was every reason to hope that the target would be reached next year. Aberdeen had dropped from fifth to tenth place in the Hack Trophy competition, but it was one of the smallest squadrons and had 20 new members.

S/L. Stevens said that fortunately nothing came of a rumour that the squadron might have to fly from Scone, and addressed a plea to university officials present on the subject of accommodation—to which the principal, Sir Thomas Murray Taylor, replied by remarking that ("as the politician says") he would keep the building wants in mind. Sir Thomas expressed the gratitude of the whole university "for the work you do in the U.A.S."; and P/O. A. A. R. Henderson, responding to the toast to the squadron proposed by A.V-M. Satterly, said classically that it was a means of "steering between the Scylla of unremitting university labours and the Charybdis of a gay social round" —in a word, one of the most valuable recreational sides of university life.

IN BRIEF

A.V-M. Asghar Khan, Commander-in-Chief of the Pakistan Air Force, has been promoted to Air Marshal. At 37, he is believed to be the youngest officer of that rank in the world.

* * * * *

H.M.S. *Eagle*, which recently returned home after a 64,000-mile cruise, it to be modernized to enable her to operate the Scimitar and Sea Vixen. This work is due to start next year.

* * * * *

An airlift to Cyprus of 500 R.A.F. personnel, replacing Cypriot employees recently debarred from R.A.F. establishments in the island, began at Lyneham on November 12. It was being carried out by Comet and Hastings aircraft and was due to continue until last Tuesday, November 18.

CIVIL AVIATION

The first Vanguard, G-AOYW, is almost completed, and is seen undergoing resonance tests at Weybridge. First flight will be in three or four weeks' time. Colour-scheme is pale blue-green and white. This is Vickers' own aircraft, and is not destined for B.E.A. or T.C.A.

THE MINISTER DROPS A HINT

AT the annual dinner of the British Independent Air Transport Association in London on November 12, Mr. Harold Watkinson, Minister of Transport, dropped a large, illuminating hint. His key words—addressed to the one annual gathering of the year at which everyone concerned with British air transport is represented, were:—

"I think that maybe it is worthwhile considering whether the excellent work done by the Air Transport Advisory Council combined with the idea . . . of an operator's licence, might not provide a clue to the right machinery for the future for solving these problems of conflicting or competing interests. I think there are attractions in the idea of a new A.T.A.C. with new powers, revised and wider terms of reference and wider discretion, to which might be entrusted the day-to-day and month-by-month handling of . . . conflicting requirements."

Making allowance for the fact that Ministerial pronouncements on such "hot" matters are almost always circumspect, one can safely assume that the Government have at last decided to overhaul the A.T.A.C. and M.T.C.A. machinery which co-ordinates British air transport.

The need for an overhaul has been advocated for a long time. A little recapitulation is perhaps the neatest way of summing up the problem as we see it.

About a year ago, on December 6, 1957, in a discussion of independent domestic opportunities, *Flight* said:—

"There is no authority whose express terms of reference are to direct the nation's air transport towards these ends [a fares policy which promotes traffic, and a route policy which intensifies traffic], no executive authority whose object is to create the conditions in which the independents can, by an expansion of the existing systems of 'associated' services, be given an opportunity to take over more routes."

Again, on May 2, 1958, "Straight and Level" suggested:—

"We don't like planners in this country. Planner is a snarl-word. We like vaguely defined institutions like cricket and the House of Lords. The idea of a C.A.B.-equivalent to foster and promote British air transport, and to protect the interests of its users, is complacently pooh-poohed with remarks like, 'Too complex for us, old boy. We don't want a lot of tame economists and lawyers messing about with our airlines.'

"In the meantime, we regulate our air transport with a Ministry which is thinking three-quarters of the time about roads, ships, railways, buses and barges; and with seven grossly overworked men on the Air Transport Advisory Council with cramping terms of reference and no executive authority at all."

Talk of the evening at the B.I.A.T.A. dinner was the *Daily Mail's* story—appropriately appearing on the front page of that morning's edition—that the means for giving considerable new scope to the independents was being considered by the Minister. He made no comment: but quite obviously much fresh thinking is going on in Berkeley Square House—and in Abbey House, where a confident Conservative Party is now preparing its 1959 election manifesto.

As we remarked last week, when discussing B.I.A.T.A's 1957-58 results, the barrier to independent expansion can be lifted only by revising the Air Corporations Act. In other words, by some modification of the scheduled-route monopoly powers of B.O.A.C. and B.E.A.

Will the Conservative Party be returned to power with a mandate to do this? Only if it is made quite clear that the Corporations are not going to be curbed. No one wants to see their efforts against massive foreign competition impaired. The Corporations are the chosen instruments, and must always be so.

But more scope for the independents *is* compatible with strong Corporations—given the right kind of executive administration.

The Minister said that we ought not to consider anything as "elaborate" or as "long-winded" as the American C.A.B.'s procedures. Long-winded? Only when airlines clamour to put up fares, and quite rightly so. Elaborate? If we think we can efficiently and fairly administer the expansion of all sections of British air transport without an elaborate executive council, we are probably deceiving ourselves.

J.M.R.

B.E.A.'s INCLUSIVE-TOUR ACE

LAST week B.E.A. made the first official pronouncement about their new move to get more inclusive-tour business. A brief announcement confirmed that they are to provide cheap fares for inclusive tours on Viscount night services ("mainly mid-week") to holiday centres in Spain, Italy, Switzerland and France.

The gist of a recent discussion in these pages ("Inclusive Tour War," November 7) was that B.E.A. proposed at the I.A.T.A. meeting at Cannes a lowering of inclusive-tour rates on scheduled services—to about 10 per cent below existing I.A.T.A. rates.

This proposal was blocked by British independents in I.A.T.A. who viewed it as a threat to their own I.T. charter business. It seemed puzzling that the independents should be worried by the B.E.A. move because: (1) The new rates would not be undercutting them; (2) They would be offered at unpopular times (mid-week night); and (3) I.A.T.A. resolutions must be unanimous to be effective—and B.E.A.'s resolution had been vetoed.

Why, then, were the independents worried? We suggested that B.E.A. had an ace up their sleeves, and it is now possible to speculate on the nature of this trump card.

I.A.T.A.'s charter operations are governed by Resolution 045. This requires, among other things, that scheduled service charters must be whole charters, and not part charters. Thus, if B.E.A. could not get their way over their I.T. proposal, they could conceivably have threatened to rescind "045"—achieving their aim by part-chartering scheduled seats. The implications of such a possible threat would obviously be far-reaching.

The outcome is that B.E.A. are going ahead with their I.T. plans for reduced rates on scheduled services. Technically, they are announcing fares which have not been approved by I.A.T.A., nor by governments—a fascinating situation. Curiously enough, the independents seem rather more mellow about this "threat" than they did a week or two ago—which suggests, perhaps, the possibility of some commercial arrangement.

ROMAN ARENA

SCATHING criticisms of their national air traffic control system have been voiced in Italy by the Italian Civil Air Pilots' Association, according to the Rome correspondent of the *Daily Telegraph*. They called Italy "most deficient in radio aids," with out-of-date beacons that were useless in bad weather and with instrument-landing installations that functioned only at irregular intervals. The radio ranges at Naples, Rome and Pisa were described as having "no practical value" and the I.L.S. at Milan as having been out of action throughout last winter. Installations had been promised at Naples, Pisa, Treviso and Catania but nothing had been done. The official statement that there was a radar control system for civil air traffic in Italy, the pilots went on to say, was a "complete invention"; there was not a single radar in Italy for this purpose and the ancient model once installed at Ciampino "never functioned in practice."

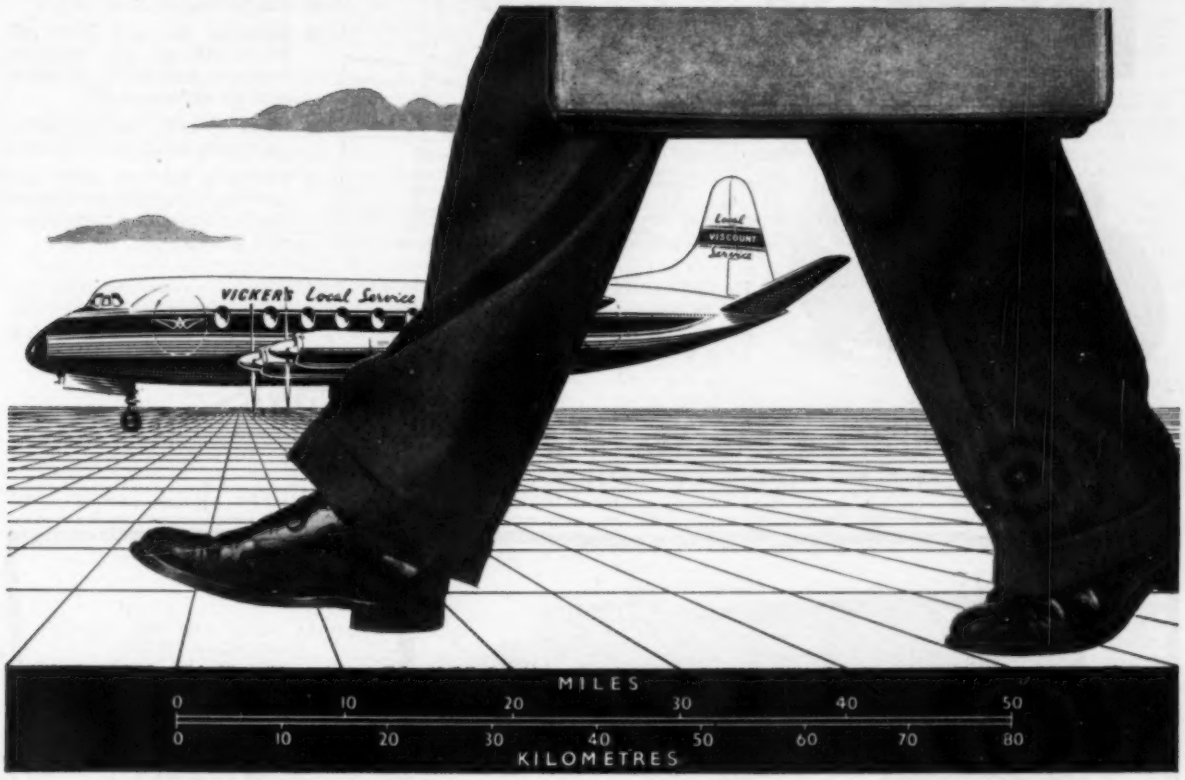
The Italian meteorological service was "something quite special"—pilots flying to Milan found it advisable to tune in to the weather service from Geneva and Zurich.

SWEET AND SOUR

AUTUMN traffic statistics are encouraging. The latest provisional figures issued by the M.T.C.A., for last September, show that scheduled traffic carried by all British airlines was up 11 per cent over 1957. At the beginning of the summer season it looked as if the year's increase was going to be in the order of 5 per cent. Now it is probably fairly safe to forecast that 1958 scheduled traffic will have increased by about 10 per cent.

Profit figures are likely to be less cheering, for overall capacity in 1958 will probably show an increase of 17 per cent. On the basis of these estimates, average load-factor will drop to 57 per cent—the lowest in the history of post-war British air transport. It appears likely that both Corporations will enter an election year showing deficits.

Now, even on the SHORTEST Sectors...



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Enthusiasm for Viscount travel has brought higher load factors and increased traffic all over the world. The new Local Service Viscount extends this valuable passenger appeal and profitability to high-density, high-frequency local networks. Introducing four-engined dependability on stages averaging 100 miles or less, it will carry between 54 and 65 passengers in quiet comfort at a cruising speed of over 300 m.p.h. Special design features enable stops at intermediate airports to be as short as 3 minutes. Ample aisle width, large panoramic windows, quiet comfort and absence of vibration are among the Viscount features that passengers will appreciate.

For short sector, high frequency service, there is no other aircraft which can offer a performance, passenger appeal and profitability comparable to the Local Service VISCOUNT

More Facts for Operators

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- Minimum demands on airport services
- Folding airsteps

The NEW VICKERS Local Service VISCOUNT

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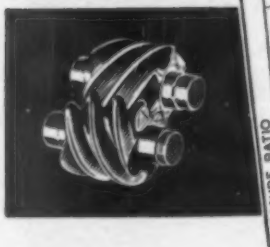
GODFREY-SRM REFRIGERANT COMPRESSORS



FEATURES

- Higher refrigerant capacity per unit weight due to high speed and high mass flow.
- Will operate over a wide range of pressure ratios.
- Flexibility—efficiency maintained over a wide speed range.
- Surge free.
- Suitable for any form of drive, AC or DC electric motors, hydraulic motors and air turbines, etc.
- Hermetically sealed units, no rotary seals, no leakage.
- Suitable for use with all commercial refrigerants in the halogenated hydrocarbon group.

The Godfrey/SRM screw compressor—NOW IN PRODUCTION—has all the advantages of a positive displacement type combined with small bulk and low weight. A typical hermetically sealed unit of 10 tons R capacity when using dichlorodifluoromethane is only 12.75 in. long and 7.5 in. dia. Weight complete with 400 cps 208v AC 3-phase motor—32 lb.

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The resultant variations are led away from the transmitter through a three-pin plug, and are fed to a ratiometer indicator operating from the nominal 24 volt supply. The instrument is substantially independent of variations in supply voltage. The working life of this transmitter is unaffected by large and high frequency pulsations in the pressure supply.
Other forms available for pressures of 40 to 120 p.s.i.

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SW/18

CIVIL AVIATION . . .

BRITISH TURBOPROP IN POLAND—

A POSSIBLE order for six Viscount 810s from L.O.T. Polish Airlines was the motive behind last week's Viscount demonstration in Warsaw. It will be recalled that last April a L.O.T. delegation visited Weybridge, and also that last August the Government rescinded the ban on the export of civil aircraft to Soviet bloc countries.

The Polish airline—which is a member of I.A.T.A.—wants to buy new first-line equipment for its expanding European network, which already extends to London, Paris, Brussels, Stockholm, Copenhagen and Vienna. Unlike the other Soviet bloc airline in I.A.T.A., C.S.A., which operates three Tu-104As and has bought (so it is reported) some Il-18s, L.O.T. appear to have no particular policy as to the "nationality" of their equipment. They already operate two second-hand Convair 340s, and a mixed fleet of Il-14s (Czech-built) and Li-2s—and their technical director, Mr. W. Leja, has voiced "particular interest" in the purchase of six Il-18s (*Flight*, November 7).

Vickers believe that L.O.T. are technically "sold" on the 810, and are now negotiating financing arrangements. The contract would be worth about £3 million.

The Vickers team was headed by Mr. Allen Greenwood, deputy general manager, and Mr. Geoffrey Page, assistant sales manager for Europe. The sales and engineering team included representatives of Vickers, Rolls-Royce and Rotol. Commander of the aircraft, which was an 812 (actually the 13th Continental Air Lines machine, temporarily registered G-APPU) was Mr. David Glaser. About 150 passengers flew in the aircraft in the course of three flights on the second of three days in Warsaw: guests included, in addition to L.O.T. and Polish Government officials, Press, radio and television representatives and local airline people.

The Vickers team was apparently almost overwhelmed with questions from the streams of L.O.T. staff who inspected the aircraft. The Continental décor made a particularly strong impression; some Poles thought it was a special Vickers sales scheme, and many did not know that Viscounts were in U.S. service.

The demonstration was arranged at a fortnight's notice, and was backed up by route and cost studies—and invitations to a cocktail party at the Bristol Hotel in Warsaw—printed in Polish. The demonstrating team were all much impressed by the Poles' great friendliness and hospitality.

Seen at Okecie Airport, Warsaw, is the Viscount 810 flown there last week (see above) by a Vickers sales team. A possible order for six aircraft is being considered by L.O.T.

—U.S. TURBOPROP IN BRITAIN

THE twenty-fifth port of call made by Lockheed Electra N7144C in the course of its ambitious sales tour was Gatwick Airport, London. Here, last Monday, the aircraft made two one-hour demonstration flights for the benefit of about 50 representatives of British airlines, Government departments, and Press.

Each flight followed the pattern of previous demonstrations, one of which, at Delhi, was described in last week's *Flight*.

The itinerary—about 18,000 miles up to Gatwick—was:—

From Burbank: Indianapolis, Montreal, Argentia, Keflavik, Reykjavik, Shannon, Amsterdam, Copenhagen, Stockholm, Oslo, Zurich, Istanbul, Ankara, Delhi, Karachi, Cairo, Beirut, Athens, Vienna, Rome, Naples, Nice, Paris, Evreux (U.S.A.F. base), Gatwick. Thence it was planned to visit: Wiesbaden, Ramstein (U.S.A.F. bases), Zurich (repeat), Geneva, Cologne, Hamburg, Dublin, Paris (repeat), New York (possibly non-stop from Paris), Burbank.

Up to Gatwick about 2,000 people (half of them airline representatives) had been flown in the course of 85 demonstrations totalling about 40 hours. There had been only two technical delays, one when an engine had to be removed at Naples for replacement of an oil seal, and another when starter trouble cost half an hour at Amsterdam.

Among those received at Gatwick by Lockheed were:—

Transair (who handled the aircraft): Mr. G. H. Freeman, Mr. W. A. Richardson, Captain F. G. Websper (chief pilot). *Trans Australia Airlines:* Mr. D. D. Laurie, Mr. R. Sexton, Mr. H. Wareham. *B.E.A.:* Mr. P. Brooks, Mr. J. P. Golding, Mr. I. Scott-Hill, Mr. B. Shenstone, Mr. Rann, Mr. Cope, Mr. O'Hanlon, Mr. J. Kenward, Mr. Gibbons. *Eagle Airways:* Mr. H. Bamberg. *Field Aircraft Services:* Mr. W. A. Bloomer. *Silver City:* Mr. M. D. Day, Mr. Kennard. *Hunting-Clan:* Mr. D. Bett. *Air Ministry:* S/L. D. P. Howard, W/C. W. Sykes. *Cathay Pacific* (for whom the actual aircraft concerned is destined): Mr. Fiennes, Mr. I. L. MacEwen, Mr. J. K. Swire, Mr. C. S. Roberts, Mr. J. S. Scott, Sir Alexander Grantham. *British Petroleum:* Mr. K. L. Sapsed. *M.T.C.A.:* Mr. Kirk. *M.o.S.:* Mr. Pinnock. Also represented were Bristol Aircraft and Vickers, and the British Press.

IS GATWICK DEAD?

REPORTS of Gatwick's death (like that of Mark Twain) are much exaggerated. But this fact has not prevented the airport's critics from relishing the prospect of an empty terminal building and unused runway. A figure of £500,000 has been quoted unofficially as the estimated loss in Gatwick's first year of operation. But it is worth recalling the impossibility of measuring the true profit or loss for any single airport in the London area when so many cost items cannot be isolated.

Gatwick's annual revenue was not expected to exceed the costs of operation in the first few years of use. And a fairly heavy first year's loss was foreseen, because the airport opened too late to catch the early summer traffic.

Broadly speaking, Gatwick was designed as a diversion airport for passengers in the summer and for aircraft in the winter. Services to the Channel Islands, the most seasonal of all British routes, were transferred to Gatwick and in August the new airport handled no fewer than 53,000 passengers. There is little doubt that summer traffic through Gatwick will within a few years have built up to capacity.

MISSING MILLION

SO fascinated were the North Atlantic carriers last month with the prospect of impending jet services that no one noticed the carriage of this year's millionth passenger across the Atlantic. This year he probably travelled in the second week of October: last year he just scraped in during the last week of December.

Traffic carried by I.A.T.A. members in the first nine months of this year was up 26 per cent over the same period in 1957. But as capacity rose by as much as 40 per cent, average load-factor dropped from 70 to 63 per cent. The third quarter was, in every way, the best period of the year. Capacity was held in check, increasing by only 39 per cent as compared with the over-enthusiastic rise of 50 per cent experienced in the second quarter. Traffic rose 35 per cent in the third quarter as against 25 per cent.

Economy-class passengers account for most of this increase: two in every three persons flying the North Atlantic now choose this class of accommodation. More passengers travel first-class than tourist-class; and, while the latter's future appears uncertain, the prospects for first-class travel seem undimmed either by recession fears or by low-fare competition. That this swing towards economy-class has been accompanied by a severe worsening in the problem of directional and seasonal unbalance is illustrated by the September load-factors for this class: 85 per cent westbound but only 40 per cent eastbound.

Freight traffic has recovered completely from the doldrums of the spring, and in the third quarter registered an increase of no less than 33 per cent. Eastbound freight now exceeds the westbound movement for the first time since 1952.

About 50 representatives of this country's airline industry and aviation Press were guests of Lockheed at Gatwick last Monday. The Electra, on its first visit to the U.K., was the object of interest (see above)

CIVIL AVIATION . . .

THE ACCIDENT ON WINTER HILL

THE report of the public inquiry into the accident to the Silver City Bristol Wayfarer which struck Winter Hill, Lancashire, on February 27, with the loss of 35 lives, has now been published (it will later be available through H.M.S.O.). The commissioner of the court, Mr. John Megaw, attributed the main cause to the action of the first officer in tuning the radio compass to the wrong station. A contributory cause was the default of the captain in failing to check that the instrument was correctly set. The commissioner made several recommendations in respect of location of cockpit equipment, recognition signals of N.D.B.s, regulations regarding altimeter settings and the definition of "contact" flying.

The aircraft, G-AICS, operated by Manx Airlines, was on a flight between Ronaldsway, I.o.M., and Ringway Airport, Manchester, with 39 passengers and a crew of three—two pilots and a stewardess. The aircraft and crew were properly certificated and documentation was in order, and although there were inaccuracies in the load and trim sheet, these "had nothing to do with the accident in any shape or form."

The route selected was the advisory direct route ADR 159 to the boundary of the Manchester Control Zone "via the reporting point over the sea near Squires Gate, Blackpool, where zone entry clearance is obtained." From here G-AICS was to fly to Wigan N.D.B. and on to Ringway. After dealing with the weather both forecast and obtaining during the flight ("extensive stratus developing 4/8 to 8/8, 600-800ft, covering hills") the commissioner explained the circumstances that led up to the aircraft being cleared up to the edge of the zone at 1,500ft.

Flying at this altitude, and shortly after passing the Morecambe Bay light vessel, Mr. W. A. Howarth, the first officer, prepared to tune the A.D.F. to Wigan N.D.B., using the Aerad Flight Guide to give him the frequency of the station (316 k/cs) and the identification letter (MYK). "There can, unfortunately," says the commissioner in the report, "be no doubt but that Mr. Howarth for some reason in fact tuned the radio compass to Oldham Beacon and not to Wigan Beacon. Mr. Howarth himself frankly admits, in the light of what he now knows, that he must have done so." The frequency of Oldham is 344 k/cs, and the identification signal MYL; the entries are separated by three lines on the relevant page of the Aerad Guide and the Commissioner dismissed the possibility that Mr. Howarth's eye had "skipped a line." The most probable cause for tuning in to Oldham was that "he had in his mind some, possibly sub-conscious, association between Oldham and Wigan."

After the first officer had set the A.D.F., Capt. E. M. H. Cairnes took over control but did not check that the radio compass was correctly tuned; and he was unlikely to have been able, in reading the magnetic compass, to distinguish that a mistake had been made. Charlie Sierra was offered (and accepted) clearance into the Manchester zone by Preston Control and cleared on to Wigan N.D.B. at a height of 1,500ft, remaining "contact." The Barnsley QNH, which should have been passed on to the aircraft when it crossed the QNH Barnsley - Holyhead equi-distant line just off the coast, was not in fact transmitted by the controller responsible, nor was it requested by Capt. Cairnes. The control officer at Preston, Mr. V. F. Lauderdale, did not do so because of his interpretation of QNH altimeter setting procedures—an interpretation with which the commissioner disagreed.

In the normal way, the Preston A.T.C.O. agreed a clearance for Charlie Sierra into the Manchester zone and the aircraft reported to Manchester "Have just left Blackpool estimating Wigan at . . . 43" (meaning 09.43). Three minutes later, Mr. Whaley, the Manchester Control A.T.C.O. asked, "What was your estimate for Wigan again please?"

"At this moment," says the report, "CS should have been very close to Wigan Beacon. As we now know, it must, as a result of a wrong setting of the radio compass, have already been too far to the east, and to have been heading for the neighbourhood of Winter Hill on its course to Oldham."

At 09.42+29 2/5 sec, the pilot of a Silver City DC-3, G-AMWV, broke in with "Don't forget the television mast, Charlie Sierra." At 09.44+21 sec, Manchester control asked, "Have you checked Wigan yet, please?" CS replied, "Negative." At 09.44+33 3/5 sec, Manchester asked, "Are you in visual contact with the ground?" Again CS replied, "Negative."

The zone radar control officer at Manchester control, Mr. M. S. Ladd, noticed that the bearing of CS on his cathode-ray direction finder was 005 deg and received an echo on the extreme edge of his radar screen bearing (as far as he could subsequently remember) 360 deg, well to the east of the course for Wigan beacon. At 09.44+38 4/5 sec, Mr. Ladd transmitted—"a prompt and energetic action"—"Charlie Sierra will you make a right turn immediately on to a heading of two five zero. I have a faint paint on radar which indicates you're going over towards the hills."

At 09.44+50 3/5 sec, CS replied, "Two five zero right, Roger." Perhaps 15 sec later, in the course of making a turn right, and in thick cloud, CS crashed on Winter Hill at a height of approximately 1,450ft.

The causes of the accident, as determined by the commissioner, were (1) The error of Mr. Howarth in tuning the radio compass on Oldham beacon instead of on Wigan beacon. (2) The failure of Capt. Cairnes to check that the radio compass was tuned on to the correct beacon.

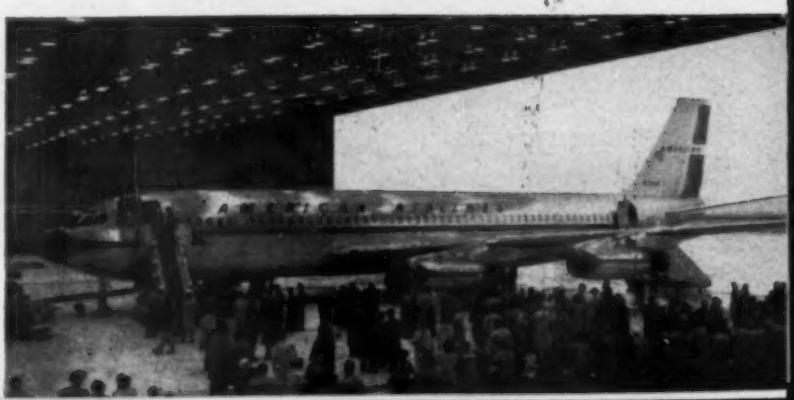
The following recommendations were made: (1) In aircraft such as this, fitted with only one ADF, the control box should be in comfortable reach of both the captain and first officer. (2) In aircraft with a high level of cockpit noise, consideration should be given . . . to a boom microphone. (3) Recognition signals of beacons bearing the same initial, or initial two letters may contribute to errors of identification. Recognition signals might bear some identification with the place name, i.e. Wigan could be "WGN." Attention should be given to increasing the rate of giving the recognition signal from two per minute to six per minute. (4) The M.T.C.A. should consider clarification of the working of the U.K. air traffic control instructions as to altimeter settings and of the Q.N.H. altimeter setting procedures in the "U.K. Air Pilot." (5) "Contact" is a state that is ill-defined: the M.T.C.A. should bring to the attention of all concerned that when a "contact" clearance is given, the responsibility of the pilot is to ensure that he not only keeps contact with the ground but also should continue to fly on that clearance only so long as the forward visibility remains sufficient for safe navigation in all the circumstances of the particular flight.

AER LINGUS CUT COSTS

MR. J. F. DEMPSEY, general manager of Aer Lingus, reviewing the half-year ended September 30, 1958, announced that the operating surplus was £94,000 greater than that achieved during the corresponding period of 1957.

During the period under review the Aer Lingus load-factor fell from 73 to 70 per cent, but revenue-hours advanced 17 per cent to 19,962 hr and aircraft utilization increased from 1,934 hr to 2,247 hr, a rise of 16 per cent. As against an increase in capacity of 38 per cent, total load increased by only 33 per cent. But despite the consequent fall in load-factor, and a drop in average revenue rate, the level of profit was improved. The explanation can be found in a remarkable cut in operating costs from 37 to 33 pence per c.t.m.

The airline may be hard-pressed to maintain this low cost-level in the months ahead, for a fleet of seven Friendships will be taking



Evidence of an airline undergoing a major equipment revolution is provided by these two pictures, showing the first Lockheed Electra and the first Boeing 707 to be delivered to American Airlines. Both types will go into service in January. American have 50 Boeing jets and 35 Electras on order

Iberia's interest in the D.H. Comet 4 was sharpened on November 11 when a Spanish mission flew in G-APDD (B.O.A.C.'s fifth) at Hatfield

At head of gangway, l. to r.: Sr. General Don Manuel Martinez Merino, Director-General of Civil Aviation, Mr. A. F. Burke, deputy chairman and managing director, de Havilland Aircraft; Sr. Don Juan A. Suances, president of Spain's National Industrial Institute. On the steps (reading downwards): Sr. Col. Don Luis Azcarraga, Director-general Proteccion de Vuelo; E. Sr. Col. Francisco Iglesias, director, chief of equipment, Iberia; Sr. Don Tomas Delgado, president of Iberia. Back row standing (l. to r.): Mr. J. C. Corby, assistant sales manager, D.H. Aircraft; Sr. A. Fuchs-Medem, Iberia's London manager; Sr. Don Fausto Bastardos, 2nd chief of equipment, Iberia; Sr. José Aràngo, chief pilot, Iberia. Front row standing (l. to r.):— Maj José Goya, assistant to D.H. agent in Spain; Sr. Don Ramon Escario, D.H. agent in Spain; Sr. Don Teodosio Pombo, captain of aircraft, Iberia; and Mr. F. H. M. Lloyd, sales manager, de Havilland Aircraft

over the DC-3 services. The first two of these were due to be delivered this week, some weeks after the original planned delivery date.

The remaining five will be delivered by April 30 next; services on U.K. routes will start before Christmas.

E.A.A.C.'s LONDON SERVICE

IT is just about two months since East African Airways caused a flutter among the British independents by applying to the Air Transport Advisory Council to operate a colonial coach class service between Dar-es-Salaam and London. The airline had hoped to start this service at the beginning of November using Argonauts on a once-weekly basis.

Since opening their U.K. service last year, East African Airways have experienced increasing difficulty in filling their once-weekly tourist-class Argonaut flight: passengers can for the same fare fly by B.O.A.C. Britannia and for £19 less can travel on a colonial-coach Safari Viscount.

The implications of this application were considerable. The whole future of colonial-coach services has been thrown into confusion by the impending introduction of economy-class travel to Africa, probably within the next two years. And what is to stop B.O.A.C. selling (or chartering) equipment to other colonial airlines for the operation of more colonial-coach services? It is hardly surprising that a quick decision has not yet been reached on a subject that touches so closely our national policy.

Meanwhile the independents are contemplating even cheaper forms of travel. Hunting-Clan have recently revealed plans for operating all-in tours to Central Africa. The cost of flying both ways in a DC-6A and spending a fortnight in Rhodesia has been given as only about £235.

BREVITIES

Pan American Airways have arranged to borrow $130m (£46m) from 39 banks to finance jet equipment.

* * *

T.C.A. will include Antigua in their Caribbean network throughout the coming winter season.

* * *

Silver City have applied to operate cross-Channel vehicle ferry services from Manston, Kent.

* * *

It is learned that among the airline offices destroyed in the serious fire which severely damaged the new Brussels Airport terminal on November 4 were those of B.E.A.

* * *

Frederick B. Ayer value two DC-6Bs just bought from Continental at £550,000 each. Meanwhile S.A.S. expect to get £320,000 apiece for 12 DC-6s now up for sale.

* * *

Electra production is nearing the "peak rate" of 10½ aircraft per month. Eight deliveries, to Eastern and American, are completed, and Electras for four other carriers are in final assembly and "in fabrication" for five carriers, including one unannounced operator.

* * *

Trans Mar de Cortes, who have recently ordered one Fairchild F-27 and have an option on a further two, have applied to the C.A.B. to operate a scheduled service between Los Angeles and points along the Gulf of California.

* * *

A potential purchaser of Comets—and also of Britannias—is L.A.V. The Venezuelan Minister of Aviation, Dr. Oscar Machado Zuloaga, said in Caracas recently that he would recommend to the government after December 7 the purchase of three Comets and "several" Britannias. Another carrier reported to be interested in Comet 4s is Air Ceylon.

* * *

The public inquiry into the Independent Air Travel Viking disaster at Southall on September 2 will be held "when the technical investigation is complete," said the Minister when pressed by M.P.s last week. He did not confirm that the Director of Public Prosecutions was also concerned. In the meantime the coroner's inquest will take place at Ealing on November 25. It is reported that a new chairman of Independent has been appointed; he is Mr. A. E. Cooper, M.P.

Lloyd Aereo Colombiano are to take delivery of Cubana's Viscount 700s as soon as the Cuban carrier's four 810s are in use.

* * *

The Indian Government have appointed a committee to investigate the cost structure of Indian Airlines Corporation.

* * *

The Viscount 763 originally ordered for Hughes Tool has now been acquired by TACA International to replace the 784 previously leased from Philippine Air Lines.

* * *

Sir Hudson Fysh, chairman of Qantas, said in London last week that a jet surcharge would "unfairly penalize" the Comet 4, 707 and DC-8, which would be "at least as economic" as older types of aircraft.

* * *

On November 10 a Seaboard and Western Super Constellation crashed while taking off from New York International. It crashed into a T.C.A. Viscount parked near the old terminal and both aircraft were destroyed. There were no injuries.

* * *

The Rotol propellers of the Viscount have just had their overhaul period extended from 2,400 to 2,700 hr by Trans-Canada Air Lines. Tests to extend this period to 3,100 hr are expected to be completed before the end of the year.

* * *

Nominations for the G.A.P.A.N. awards for 1958 should reach the Guild office at 14 South Street, Park Lane, London, W.1, not later than December 15. The awards are the Johnston Memorial Trophy, the Cumberbatch Trophy, the Brackley Memorial Trophy, and the Derry and Richards Memorial Medal.

* * *

Fairchild's designation of the passenger-cargo version of the Friendship is F-27B. Two of an order for three have been delivered to Northern Consolidated Airlines, Alaska. Meanwhile West Coast Airlines have received their six F-27s; services will start in the first quarter of 1959.

* * *

According to a spokesman for the Cuban rebel forces, the rebels were not responsible for the crash of the Cubana Viscount which was forced down, allegedly by rebel action, on November 1. "We want to make clear that this was not done with our consent or approval," said the spokesman. A Cubana DC-3 was later seized by rebels on a flight from Mauzanillo to Holguin.

Left to right: Messrs. C. T. Wilkins, John Cunningham, Harry Povey, W. F. Shaylor and Professor A. D. Baxter

D.H. Appointments

IMPORTANT changes in membership of the Board of the de Havilland Aircraft Co., Ltd., were announced last week. Mr. C. T. Wilkins, chief designer, Hatfield, and Mr. John Cunningham, chief test pilot, were elected to the Board, their appointments taking effect from December 1. Mr. Harry Povey, who was for many years in charge of production, retires from the Board on November 30. Mr. R. E. Bishop, hitherto design director, becomes deputy managing director; Mr. R. M. Clarkson becomes research director; and Mr. Wilkins is appointed chief designer to the company.

C. T. Wilkins, O.B.E., F.R.Ae.S., has had thirty-one years' experience in aircraft design and is one of the most knowledgeable technical men in the industry. He has been in the D.H. design office for all but two years of this period, and was appointed chief designer at Hatfield on December 1, 1954.

He joined de Havilland at Stag Lane in 1928, left the company in 1930 during the world trade recession to work first with the Cierva Autogiro Co. and then with Handley Page, and returned to the Stag Lane drawing office in 1932. Since then he has been occupied on practically every D.H. aircraft design project. He was closely concerned with work on the Mosquito and has been occupied with every phase of Comet development.

John Cunningham, D.S.O., O.B.E., D.F.C., D.L., has been chief test pilot of the de Havilland Aircraft Co. since October 1946, when he succeeded Geoffrey de Havilland. He has been responsible for the flight development of all D.H. aircraft since then, and on Comets alone has flown 2,500 hr as captain.

He entered the de Havilland Aeronautical Technical School in 1935 and in the same year joined No. 604 Sqn., Aux.A.F. His first position in the company (in 1938) was as a member of the light aircraft development department. During the war he had a brilliant career as a night-fighter pilot, winning the D.S.O. with two Bars and the D.F.C. and Bar. He returned to civil life as chief test pilot of the D.H. Engine Co., continuing in the R.Aux.A.F. until June 1948. In that year he set up a world height record in a Vampire.

Harry Povey, F.R.Ae.S., who is retiring after 7½ years' membership of the Board, has been described as "a production engineer without peer in the aircraft industry." From 1914, when he first went to the Royal Aircraft Factory at Farnborough, Mr. Povey has been continuously concerned with the production of aircraft, engines and propellers—until in recent years events have compelled him to turn his talent to the problems of long-range missile production.

His first association with de Havilland occurred indirectly in 1917, when he took the post of works manager with May, Harden and May, a subsidiary of the Aircraft Manufacturing Co., who were building F.2A flying-boats for the R.N.A.S. He rejoined the D.H. team in 1924, nearly four years after the formation of the company, and in 1926 was appointed chief inspector of aircraft, and then of engines.

When de Havilland decided to embark on propeller manufacture, Mr. Povey went to America to study the Hamilton company's methods and on his return introduced a new propeller manufacturing technique in the D.H. factory at Stag Lane. Until the company's separate engine and propeller divisions were formed (shortly before the war) he was responsible for aircraft, engines and propellers.

Mr. Povey's wartime work can be only briefly summarized here—perhaps in one word, Mosquito; for once this remarkable aircraft had been officially accepted and huge orders followed, he played a leading part in planning the complex production programme, which involved a network of sub-contractors both in this country and Canada, where he set up a production organization. In addition he must be credited with much of the planning under which some 2,500 Tiger Moths, Dominies and Oxfords were built at Hatfield in 1939-45.

Mr. Povey returned to England in 1944 as Chief Inspector (Aircraft) and in 1945 was appointed general production manager. Since the war his main preoccupation has been with the Comet, but he has also been responsible for much other peacetime work. For example, he brought the D.H. Chester factory into commission in 1948. "His departure," say the company, "removes a forthright and commanding personality that will be difficult to replace."

The Board now consists of: Mr. W. E. Nixon, chairman; Mr. A. F. Burke, deputy chairman and managing director; Mr. F. E. N. St. Barbe, director; Mr. R. E. Bishop, deputy managing director; Mr. R. M. Clarkson, research director; Mr. A. S. Kennedy, director; Mr. C. T. Wilkins, chief designer; Mr. J. Cunningham, chief test pilot.

Also announced by de Havilland Aircraft are two executive appointments, both becoming effective from December 1. Mr. R. G. McCoy, B.Sc., A.F.R.Ae.S., A.M.S.L.A.E., is made general manager; and Mr. D. R. Newman chief aerodynamicist.

Mr. McCoy joined D.H. in May 1953 as deputy service manager, becoming service manager in April 1954; he was responsible for the service department until July this year, and from January 1956 has acted as assistant to the managing director. Mr. Newman has been in the aerodynamics department since 1938. When he takes up his new appointment, Mr. M. Herrod-Hempsall will remain responsible for administration in the aerodynamics and allied departments.

Two new directors of the de Havilland Engine Co., Ltd., were appointed on November 11. Mr. W. F. Shaylor, commercial manager, and Professor A. D. Baxter, M.Eng., M.I.Mech.E., F.R.Ae.S., F.Inst. Pet, chief executive of the rocket division and the nuclear power group, were elected to the Board, Mr. Shaylor becoming sales director. The new appointments are to take effect from December 1 and the Board will then be: Mr. A. F. Burke, chairman; Mr. H. Buckingham, managing director; Mr. W. E. Nixon; Mr. J. L. P. Brodie, engineering director; Dr. E. S. Moult, technical director; Mr. M. G. Ash, financial director and secretary; Mr. W. F. Shaylor, sales director; and Prof. A. D. Baxter, chief executive, rocket division and nuclear power group.

Mr. Shaylor joined the company as commercial manager in September 1951, taking up this position under Mr. Buckingham (then business director) following the integration of Airspeed and D.H. Aircraft. He has thus been responsible for the contractual and business departments of the engine company for seven years. He had previously been with Airspeed since 1937, joining as business manager and in 1950 being appointed to the Board as commercial director.

Prof. A. D. Baxter has been chief executive of the D. H. Engine rocket division and nuclear power group since last year, having joined the company from the College of Aeronautics at Cranfield, where he had been deputy principal since 1954. His association with the College began four years earlier, when in 1950 he was elected to the newly created Chair of Aircraft Propulsion. He had previously been first Superintendent of the Rocket Propulsion Department at the R.A.E. Westcott, and prior to that (from 1944) worked on ramjet and rocket research in the then newly formed Gas Dynamics and Supersonics Division of the R.A.E.

THE WORLD'S AIRLINER POPULATION

SINCE last spring the number of airliners in civil operation has increased from some 5,400 to 5,800. North American manufacturers have contributed 4,800 of this total. By next spring the world airliner population should touch 6,000, the American contribution approaching the 5,000 mark. There are today nearly 1,000 British commercial aircraft in use: this figure will certainly be passed next spring.

Douglas continue to dominate the picture, their products accounting for half the world total. The other four giants of the airliner business—Convair, Lockheed, Vickers and de Havilland—each have about 500 aircraft in airline operation.

The latest *Flight* census will be found in this issue, on pages 806, 807 and 808; the first two pages list those aircraft produced in the U.S. and Canada, and the last page shows British civil aircraft. The industries of these three countries account for 99 per cent of the world's airliner population, manufacturers elsewhere being responsible for only 76 airliners, most of which are French (Bréguet Deux Ponts—Air France 12; Nord Noratlas—U.A.T. 9, Air Algerie 3, Arkia 2; Sud-Est Languedoc Aviaco 8, Air Liban 1; Sud Est Armagnac—SAGETA 6; Sud-Ouest Bretagne—Air Algerie 2, Air Maroc 7, COSARA 4). The only other manufacturers to be represented are Saab (17 Scandias are operated in Brazil by VASP) and de Havilland Australia (eight Drovers are in airline use—T.A.A. 4, Fiji Airways 3, Qantas 1).

The most remarkable feature of last spring's census (*Flight*, March 28) was the large number of elderly aircraft still in use. While this continues to be the case, a more significant feature of this latest census is that it reflects the advent of the jet age. The Boeing 707 and Comet 4 have already found their way into these pages, and next spring's issue will include the Electra, Friendship and Caravelle. In preparation for receiving new jet fleets, airlines have started to dispose of much piston-engined equipment. (Such is the present spate of activity in the used-airliner market that the compilers of this issue have been hard pressed to keep the record up to date.) A prominent feature of this disposal process is the emigration of early two- and four-engined piston equipment from the scheduled airlines of North America and Europe to their non-scheduled brethren and to scheduled carriers in Latin America, Africa and Asia.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Comet and 707 Noise

ON reading your article on jet noise in the November 7 issue the uninitiated may well ask, "Why all the concern about the Boeing 707?" since the noise levels for the 707 and Comet 4 appear comparable. At the same distance from an observer the levels are, in fact, comparable; but the problem is not only one of absolute noise-level but of altitude too.

A more realistic impression of the American reports quoted can be given by referring to the climb performance of the two aircraft as well as to their noise levels alone.

For example, under comparable conditions of maximum weight on a standard-temperature, zero-wind day, the altitude of the Comet 4 would be 1,000ft at a position 2½ miles from the start of take-off. At this same position the altitude of the 707 would be 350ft. The comparable noise-levels would then be 108 db for the Comet and over 117 db for the 707. The difference between the two would become even greater if one assumes that at 1,000ft the Comet could reduce to climb power whereas at 350ft the 707 would almost certainly need to maintain maximum power.

Alternatively, to achieve comparable altitude, and hence noise-level, the 707 would need to be reduced to a weight of just over 200,000 lb, compared with the maximum weight of the Comet.

It is only when this further aspect of the problem is taken into consideration that the reason for the penalties likely to be encountered by the 707 become clear.

St. Albans, Herts. D. P. HOWLETT.

YOUR article "Jet Noise—the New Airport Problem" (November 7) does not fully summarize the studies made by Bolt, Beranek and Newman Inc., and so creates a false impression of comparative take-off noise-levels.

The table shows quite correctly that the levels produced by the two jet aircraft in flight, at the same altitude and at maximum power, are of similar intensities.

However, as the reports are concerned with air-to-ground noise, a comparison should also be made of the take-off climb performances included in these reports.

Considering a position three miles from the start of take-off —this corresponds to the nearest heavily populated area encountered when taking-off from London Airport—the altitudes of the Comet 4 and Boeing 707 can be compared at maximum take-off weight, assuming standard atmospheric conditions and zero wind. The Comet 4 is then seen to be at an altitude of 1,400ft, whereas the Boeing 707 is at 400ft. A true comparison of noise levels experienced on the ground can then be made from the table in your article, the sound pressure levels being 104 db for the Comet 4 and 113 db [surely 117 db?—Ed.] for the Boeing 707. Also, at this position, the Comet engine power could be reduced, thus decreasing the Comet 4 noise levels still further.

This illustrates why the Boeing 707 is considered noisier than the Comet 4 and likely to suffer more from the restrictions imposed. The absence of this further comparison has caused several people to think that the Comet has been favoured by the airport authorities.

Rotherham, Yorks. JOHN F. WILBY.

Radio Recognition

YOUR correspondent Mr. J. Mercer (November 7) raises the question of an apparent discrepancy between radio call-signs and aircraft registration letters. I believe there is no definite rule that the call-sign must correspond with the registration, but for obvious reasons this arrangement is almost invariably adopted. On the occasion in question the operators were presumably using the correct procedure and Mr. Mercer heard the report as "Golf—Alfa—Tango—Foxtrot—X-ray." If the phonetic alphabet was not used then it may have been a simple case of incorrect hearing.

I have spent some hundreds of hours monitoring the A.T.C. frequencies, both H.F. and V.H.F., and until reading Mr. Mercer's letter had always assumed that the Craughton A.T.C. (which is pronounced "Krauten" by American operators) was situated in Germany! Perhaps it would help to clarify the position for Mr. Mercer and others to point out that North Atlantic and European A.T.C. arrangements separate military and civil traffic; the centres at Craughton, Lages, Keflavik and Rhein-Main deal only with military aircraft. U.S.A.F., U.S.N. and Military Air Transport Service aircraft prefix their call number with the words "Air Force," "Navy" or "MATS" respectively and pass all their routine traffic via the centres already mentioned. They may occasionally contact a civil centre when entering a Flight Information Region or requesting permission to cross an Airway.

The civil centres are London, Shannon, Paris and Iceland (Gander may also be heard under favourable conditions). Aircraft working these stations use company names as call-signs but they are always followed by a flight number. Among others can be heard "Speedbird," Pan American, T.W.A., "Bealine," Air France and Seaboard. It seems possible that the use of registration/call letters may be limited to non-scheduled services such as the "Skyways" flight referred to in Mr. Mercer's letter.

The aircraft using the call "Falcon Special" seems to be breaking all the rules; one presumes it to be a military type operating from Burtonwood, but it apparently uses the civil A.T.C. frequencies. One fact indicating that the U.S.A.F. is the operator of this peculiar bird is the use of the code-word "Slow Motion 3." No, Mr. Mercer, this is not a method of indicating the number of power units still in operation but a form of telegraphic address and is usually preceded by the words "Relay to . . ." other code words such as "Coldeck 3" are sometimes used in the same way.

One thing which becomes increasingly apparent is the need for additional channels on these communication networks; there often seems to be a certain lack of R/T. discipline, and language difficulties are the cause of much delay and frustration. The military frequencies are appallingly crowded but it is most noticeable that as soon as any emergency occurs the routine chatter is cut as if by a switch.

Perhaps these remarks may prompt someone with greater knowledge of procedures to answer Mr. Mercer's query and one which has been exercising my powers of deduction for some time without result. It is: Who (or what) is "Sky King," and when will they let him answer?

Weymouth, Dorset. W. BUDD.

I TRUST you will be able to publish any letter you receive giving information about the "Falcon Special" referred to by Mr. Mercer in the November 7 issue of *Flight*.

There is a four-engined aircraft that roars over here at about 2330 G.M.T. every night. I believe it is on a met. flight from Burtonwood. If it is the same machine, readers may be able to tell me three things about it. Firstly, obviously, where it goes; secondly, why it carries so many lights; and, if I might be permitted a frivolous question for my third, whether it is the aircraft that has in previous years dropped letters to "Father Christmas" over the North Pole for local children.

Liverpool, 8. E. J. ROBERTS.

The Bristol Scout

I WAS interested in J. M. Bruce's description of the Bristol Scout in *Flight* for October 24. I flew a good deal in the 80 Le Rhône version; as a flight commander on a training station, I had one entirely for my own use.

I see that the side-by-side Bristol, the S.2A, was "promptly nicknamed 'Tubby'." Actually it wasn't called anything of the sort—it was promptly named "the pregnant Bristol" and I never heard it called anything else.

London, S.E.1. E. F. HAYLOCK,
G/C., retd. (Editor, *Yachting World*)

Airliner Liveries

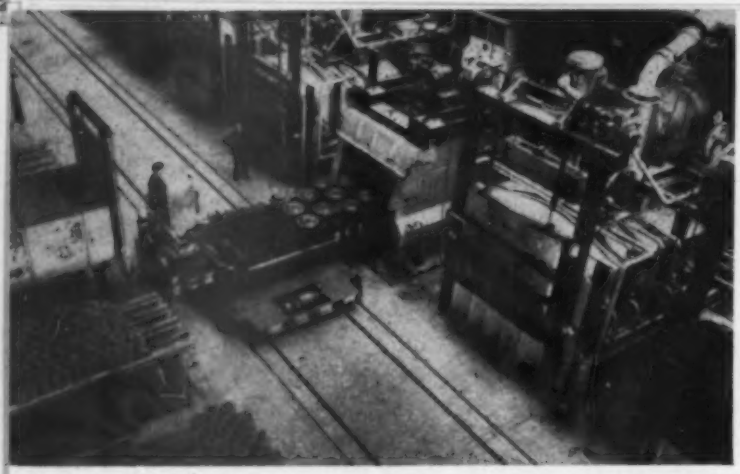
SURELY the photograph chosen to illustrate Mr. Pitt's letter in *Flight* of October 31 depicts a Viscount of Eagle Airways (Bermuda), Ltd., and carries the Bermudian flag, not the British Civil Air Ensign. I suggest the letter was referring to the Eagle Aviation U.K. fleet.

Sanderstead, Surrey. EAGLE EYE.

FORTHCOMING EVENTS

Nov. 24. R.Ae.S.: "Inertial Guidance," by J. E. Pateman.
Nov. 24. Royal Society of Arts: Cantor Lecture (1), "The Birth of the Aeroplane," by C. H. Gibbs-Smith.
Nov. 25. Guild of Air Pilots and Air Navigators: "The Jetstream," by E. Chambers.
Nov. 26. Kronfeld Club: "Test Flying," by T. W. Brooke-Smith.
Nov. 28. Elstree Flying Club: Annual Dinner.
Nov. 28. R.Ae.S. Graduates' and Students' Section: Annual Dance.
Nov. 28 Dec. 4. Electronic Computer Exhibition, Olympia, London.
Dec. 1. Royal Society of Arts: Cantor Lecture (2), "The Development of the Aeroplane," by Peter W. Brooks.
Dec. 3. Kronfeld Club: "Gliding in Uganda," by Basil Bell.
Dec. 4. R.Ae.S. (Main Lecture, at Birmingham): "Freighters—a General Survey," by E. D. Keen.
Dec. 5. Helicopter Association: Discussion Evening.
Dec. 6. British Interplanetary Society: "Rocket Nozzles and Jets," by E. T. B. Smith.
Dec. 8. Royal Society of Arts: Cantor Lecture (3), "The Future of the Aeroplane," by Eric Mensforth.
Dec. 9. R.Ae.S.: "Application of a Constant Frequency, A.C. Electrical System to Aircraft and Missiles," by S. S. Hall and A. Thomas.
Dec. 9. R.Ae.S. Graduates' and Students' Section: "The Future of the British Aircraft Industry," by E. C. Bowyer.

R.Ae.S. Branch Fixtures (to Nov. 28): Nov. 25, *Belfast*, film show. Nov. 26 *Christchurch*, "Parachutes," by F. B. Jackson. Nov. 27, *Isle of Wight*, "The Water Barrier has been Broken," by P. R. Crewe; *Southend*, "Agricultural Aircraft."



Firth-Derihon Stampings, Ltd., have completed the installation of a new central heat-treatment plant at their Darley Dale works. In this picture the four-arm turntable-type charger is withdrawing a batch of gas-turbine discs from the oil-quench machine, on each side of which is seen part of the battery of high- and low-temperature furnaces. Among contributors to the design and equipment of the plant were Gibbons Bros., Ltd., Honeywell Brown, Ltd., Hartons, Ltd., and the Brown-Firth research laboratory

THE INDUSTRY

U.S. Approval for British Valves

AFTER prolonged testing of two groups of valves up to 2in dia. at the Aeronautical Engineering Laboratory, Navy Yard, Philadelphia, Saunders Mk 4 spherical-plug valves have been recommended for use on U.S. Naval aircraft. As the tests are based on Specification MIL.5018A this recommendation means that the valves can also be used on military and civil aircraft in both America and Canada.

The Saunders Valve Co., Ltd., are already supplying these fuel valves for a number of British aircraft, including the Vanguard, Argosy and Herald. They state that a 1¼in dia. prototype valve at present undergoing a life endurance test has exceeded 1,800,000 cycles of operation and is still in good condition; this, they add, suggests that the valve should outlast the aircraft for which it is designed. Motor units and spindle seals can be changed without removing the valve from the pipeline or de-fuelling the aircraft.

Smiths in Canada

A YEAR of continued expansion in a new plant at Don Mills, near Toronto, has just been completed by S. Smith and Sons (Canada), Ltd. An additional depot to cater for C.P.A.L. and other west-coast operators using Smiths equipment has been opened by the company at Vancouver, and both plants are now equipped with a full range of test equipment.

The aviation division of Smiths (Canada) was formed in 1956 to meet the needs of North American operators of British aircraft fitted with Smiths autopilots and Flight Systems. In November 1957 the company moved into the new Don Mills factory, which includes a controlled-atmosphere instrument overhaul laboratory. Among the executives of the firm are Mr. P. E. A. Talbot, in charge of the aviation division; Mr. Frank Wood, head of the overhaul laboratory at Don Mills; Mr. M. J. Rant, sales engineer; and Mr. Lloyd Greenwood, in charge of the Vancouver depot.

Aids to Inspection

TWO new "Mirotilt" probes, 12in and 24in in length, have been added to the range of Probe-Lites made by Engineering Developments, Ltd., Mark Road, Hemel Hempstead, Herts, for the internal inspection of hollow objects. A feature of the "Mirotilt" is that the angle of the mirror can be controlled by means of a push-button at the handle end while the instrument is in use.

The company has also added to the range of its viewing instruments a Probe-Lite giving a magnification of ×8 for the examination of surfaces. A resting-pin is fitted to make it easy to maintain correct focal length while the magnifier is traversing a surface.

Versatile Nyquist Plotter

IN the testing of servo-mechanisms it is frequently necessary to produce a graphic plot of characteristics in the form of a Nyquist diagram. Servo Consultants, Ltd., of 17 Woodfield Road, London, W.9, are marketing an automatic plotter which, they state, combines a high speed of measurement with quick response. The unit is in a container measuring approximately 2ft along each edge, and the complete weight is about 150 lb.

The system comprises an electro-mechanical frequency generator which supplies a signal to the equipment under test; an accurate phase-detector then measures the difference in angle between the outgoing and incoming signals and a servo-mechanism measures the amplitude of the incoming signal. The plot is obtained in the form of readily identifiable frequency markers between 0.25 and 100 c/s. A complete plot under automatic control can be produced in 5 min; if response below 1 c/s is not required the time is reduced to 90 sec.

IN BRIEF

Mr. G. C. R. Eley, C.B.E., has joined the Board of the British Oxygen Co., Ltd.

* * *

Dunlop Aviation Division (Holbrook Lane, Coventry) have published a new edition of their impressive aircraft-equipment manual. Subjects covered—in considerable detail—include tyres, wheels and brakes; hydraulic, pneumatic and electric components; de-icing equipment; flexible pipes; and rubber accessories.

* * *

Mr. John Davison, O.B.E., F.C.I.S., managing director of the de Havilland Aircraft Co. of South Africa (Pty.), Ltd., has been elected president of the Chartered Institute of Secretaries for the forthcoming year, in succession to Mr. E. G. Hardman. This is the first occasion on which a Commonwealth member of the Institute has been elected to the presidency.

* * *

Mr. B. E. Richmond has relinquished his position as general factory manager of Tecalemit, Ltd., in order to concentrate his activities as managing director of Foamite, Ltd. He is succeeded as general factory manager at Plymouth by Mr. J. E. Drinkwater, who for the past two-and-a-half years has been his deputy and was previously chief production engineer. Tecalemit also announce the appointment as chief engineer of Mr. H. E. Jackson, B.Eng., formerly chief development engineer.

* * *

Hedley S. Crabtree and Co., Ltd., consultant engineers, announce the appointment of Mr. Jack Woodhouse, A.F.R.Ae.S., as deputy to their principal, Mr. Hedley S. Crabtree. He will act as a principal within the firm on all matters relating to air transport and the development of civil transport aircraft, engines and equipment. Mr. Woodhouse first joined Hedley S. Crabtree and Co., Ltd., in 1954 and has now returned after two-and-a-half years with Trans-Mediterranean Airways as chief engineer. He served with Imperial Airways up to 1939, then successively with the Bristol Aeroplane Co., the A.R.B. and B.S.A.A., being seconded to West African Airways following the amalgamation with B.O.A.C.

* * *

A four-day exhibition which opened at the College of Aeronautics, Cranfield, last Tuesday (November 18) has as its theme the properties and uses of nickel, nickel alloys and related materials. It has been organized by the Mond Nickel Co., Ltd.

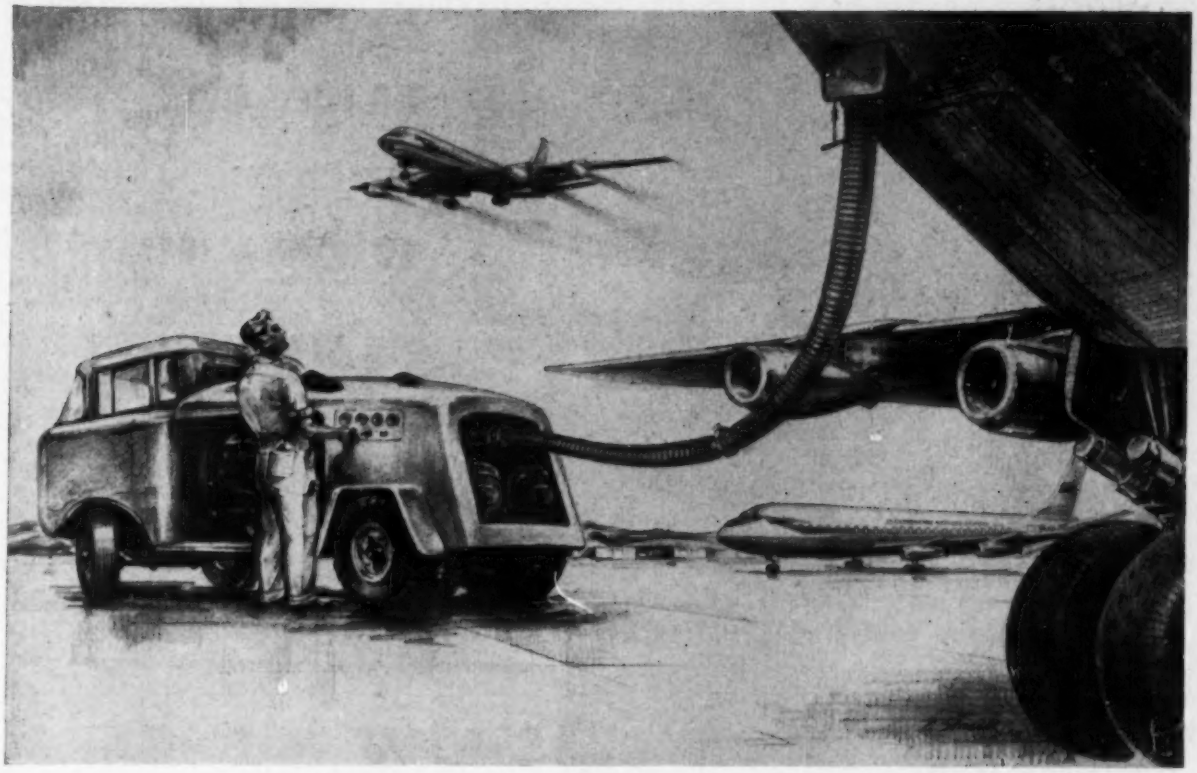
* * *

We are asked to make two amendments to company addresses quoted in our "Airports and their Equipment" number of November 7. The address of Cementation (Muffelite), Ltd. (page 745 of that issue) is 20 Albert Embankment, London, S.E.11; and that of Detuners, Ltd. (page 752) is 58 Highgate West Hill, London, N.6. In the same issue, also, the airliner stairs illustrated on page 731 should correctly be described as the Edghill "Autostair," mounted on an Austin Omnitruck chassis.

* * *

An attractive illustrated booklet on silicone rubbers has been issued by the Nobel Division of Imperial Chemical Industries, Ltd.

For eleven years general manager of Marconi's Wireless Telegraph Co., Ltd., Mr. F. N. Sutherland, C.B.E., M.A., M.I.E.E. (seen in this portrait) has been elected to the Board, and also to that of Marconi Instruments, Ltd. Another appointment to the two Boards is that of Mr. Paul de Laszlo, O.B.E., who has been associated with the Marconi group for a number of years



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AUSTER ALPINE, air frame 267 hours, Gipsy Major 10, Mk 2 engine, 129 hours since complete overhaul. Dual control, full blind flying panel, engine silencers, starter, navigation lights, battery, generator, cabin heating, 32 gal fuel, bench rear seat, Murphy 23-channel V.H.F. C. of A. until July 1959. Immediate delivery, ex-Kidlington. £2,750.

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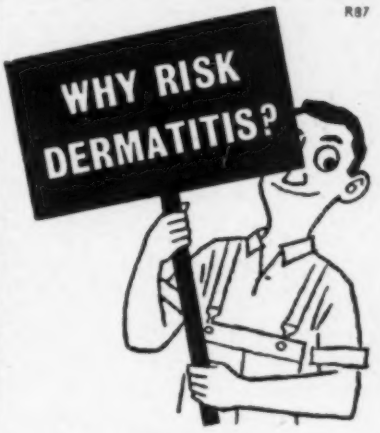

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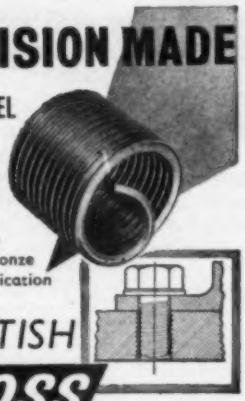

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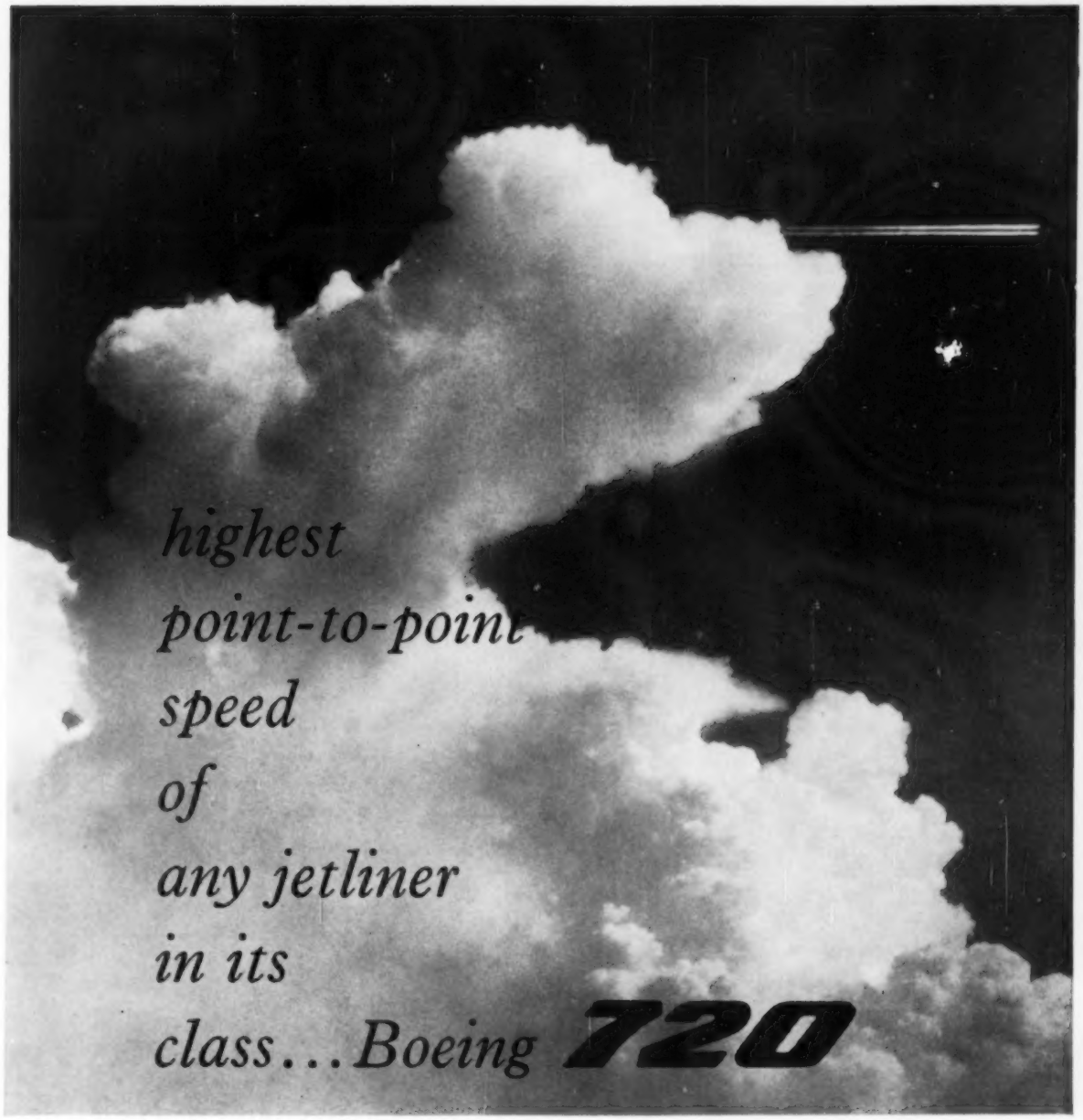

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